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J. R Seshagiri Rao

INDIAN SCIENCE CONGRESS HANDBOOK

'*For wee are borne to quest and seeke after trueth; to possess it belongs to a greater power.*'—Florio's '*Montaigne.*'

MADRAS
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PREFACE

is handbook has been prepared for the use members attending the sixteenth annual eting of the Indian Science Congress to be d at Madras from January 2nd to 8th, 1929. Nothing in the nature of a complete or nprehensive guide has been aimed at. A es of articles has been collected on subjects ch, it is thought, would, specially, interest members and which they would be able to d at a time when they are likely to have more ure than during their actual sojourn in dras.

The Indian Science Congress had its first eting in 1914 under the auspices of a mittee of the Asiatic Society of Bengal who anged the first meeting held in Calcutta in year. The Science Congress weathered period of the Great War and has grown dily ever since in its influence in stimulating ntific research in India. Like the British ociation for the Advancement of Science, on

which in its small beginnings the Science Congress has been modelled, its aims are threefold :—(i) to furnish opportunities for scientific workers to get in touch with those working on allied subjects ; (ii) to encourage research ; (iii) to make scientific knowledge accessible to the general public.

A. F. MacCulloch.

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SHORT SKETCH OF THE ANCIENT HISTORY OF SOUTH INDIA

THE history of South India may be said to gin with the beginning of the Christian era far as the material for that history of a South ndian character is concerned. For historical nowledge of the South Indian region, we can back a number of centuries, five, six or even, according to opinion, if the information s based on a knowledge of South India as ncorporated in Sanskrit literature. Almost rom the days of the Brahmanas the horizon of ne Aryan vision in the south extends till in the ge of the Mauryas, we may say that the ndian-Aryans had a knowledge of the whole f South India. Megasthanes has reference to e Pandya country and its having been under a oman ruler. There are numerous references what is now Berar, that is, to the whole the Nizam's Dominions, as a forest region, d ultimately to a knowledge of Kanchi as a

centre of importance for Sanskrit learning, even to the country of Kerala, as we come d the stream of time through the grammar Panini, and his contemporaries, Katyayana Patanjali, so that when we come to the be ning of the Christian era, knowledge of S India among the northerners may be rega as almost complete. But actual knowledg South India from monuments of various k goes back centuries, it may be millenniums the basis of archaeological and ethnolo material. Such remains as have come down take us to neolithic times and even to paleol times to some considerable extent, so that theory has been propounded that the De part of South India was the home of Without attempting to go into this perio any detail, we may come on to the r historical period beginning with the age o Mauryas in the north. We have refere during the time to the kingdom of Kalin the existence of the territory of the And to the kingdom of the Asmakas on Godavari in the west, coming down southw to even the viceroyalty of Asoka at Suvarn

h may be safely located somewhere near
ki in the south-west corner of the Nizam's
inions. Asoka's authority extended to as
s the frontier of Mysore and came into
matic touch with the three-crowned kings
e south, the Chera, Chola, Pandya, and
a fourth further north, the Satiyapura.
e is also some information to hand in the
st pieces of Tamil literature of an invasion
amil India by the Mauryas and of its being
back by the effort of the Tamils.

far, however, as South Indian material
istory goes, the earliest extant literary
ial is what goes by the collective name of
am works, ascribable, on satisfactory
ds, to the first or second century of the
tian era. In the centuries on either side
Christian era, there has been such a con-
ble amount of fermentation and growth,
introduces us immediately to an age of
ant culture of Tamil literature. Tamil
to have attained to a certain amount of
h and development as a language, and had
ent natural vigour for further growth, and
as one could judge from extant literature,

it seems to have required the contact of San
to acquire new vigour and exhibit that gro
which we see in the Sangam literature, suc
the extraordinarily quick growth that one ob
by the horticultural process of grafting.
seems the only way of accounting for the su
appearance, as it were, of an age which
cover a number of centuries, of the f
efflorescence of Tamil literature.

In these early days, Tamil India was ma
off as a distinct entity. To the north of it
the region of the *Vaḍuhar*, according to
known in the two branches, to Telugu *Vaḍ*
on the north-eastern frontier extending inw
from the sea to almost Adoni, and to
Kannaḍa *Vaḍuhar* extending inwards
there to almost the Western Ghats w
Vaḍuharmunai, the frontier post of
Vaḍuhar in each of these, the first at Tir
and the second in the region of Molkalmu
the north-eastern corner of Mysore, wher
Asokan Edicts are found. The region
the coast stretching further west, pe
might have been even beyond, was k
among the Tamils by the name *Koṇ-Kā*

modern Konkan. Beyond this was the finite region of forest, which the Tamils ed *Dandaranyam*, the equivalent of the skrit *Dandakaranyam*. This is what is de- ed by the classical writer, Pliny, the author he *Periplus and Ptolemy*, as *the* region of forest. Beyond that were the kingdoms n as the Asmaka, the Andhra and Kalinga. have reference to a king who ruled in a derable part of what was the Dandaka t, and Sanskrit literature has it that it ne an inhospitable forest because of the ties of a ruler who brought on this calamity e land that he ruled. That is the earliest se that we get of South India, in the south Vindhyas. Before this period, the infor- n that the northerner had of the south was ague southern road, Dakshiṇāpatha as ed to the northern road, Uttarāpatha. that yague beginning, knowledge widens the middle of the second century B.C. jali knew the utmost south.

Aryan penetration of this region seems e been a gradually expanding slow pro- When we come to the age of the Mauryas

and, specifically, the Mauryan Empire of A
we find that his authority stopped short a
northern frontier indicated above, the *Vaḍ*
munai, the frontier post of the *Vaḍuhar*. V
his authority stopped short with that
he claims that his influence penetrated int
territory of his neighbours in this par
he claims that his influence prevailed i
west among the territories of his
neighbours of Asia, Europe and Africa.
in the distant Tamil south, settlemen
Brahmans, Buddhists and Jains had be
general, while the royal propaganda backe
official authority stopped short there. So
is stated clearly by Asoka himself. Whe
empire of Asoka broke up and the regi
South India under him passed into the
of the Andhras, *the* power more than any
which was responsible for the disruption
empire, these Andhras ruled for about
generations, according to the Puranas, a
a period of five centuries and more. Thei
had been patterned on that of the Ma
empire, and they seem to have shown
selves pretty early votaries of Aryan cu

nat up to the frontier indicated the country become thoroughly Aryanised. Across this ier into the farther south, the process of anisation was perhaps not quite so thorough, it was, none the less, very important and ful. It seems to be this contact that made il get into full blossom and fructify into that body of literature generally known as the gam literature, which gives us the first real ht into the history of South India. During period of the Andhra domination in the nan, South India seems to have been inde- ent and powerful and equally prosperous the region of the Andhras. The glimpse we get of this region from foreign writers, as we have already referred to, is amply rmed by what we can learn of it from the enous Tamil literature. The era was one eat prosperity and commercial activity both nal and internal. There were orderly rnment and established authority to permit, fully, of the prosecution of this trade n and commerce across. The Tamil region ivided into three kingdoms, Chola, Pandya Chera, and a certain number of chieftancies

varying according to time from five to fourteen. The fertile coastal region of the Kaveri delta extending a considerable distance north and south constituted the Chola kingdom; the region beginning with Vellar running near the town of Pudukotta extending southwards to Cape Comorin and from sea to sea was the Pandya kingdom. The west coast north of Kottayam extending almost up to Cannanore along the coast was the Chera kingdom. The territory in between extending from the frontiers of the Chola kingdom to the foreign frontier of the *Vaḍuhar* was distributed among the chiefs, some of whom had their territories within the kingdoms of these kings. Divided as it was in this fashion, and conducting wars pretty frequently, as we have evidence, it seemed still to have enjoyed a very considerable amount of peace and plenty with all the necessaries of a well-ordered life for the people assured to them. When we emerge from this, just at the period when the empire of the Andhras passes out of existence by an inanition followed by dismemberment about the middle of the third century, we find some kind of cataclysm coming

over the south as well. The kingdoms and their prosperity pass into an eclipse and we almost lose sight of what was exactly the state of things.

All this darkness seems to have been caused as a consequence of the cessation of the Andhra empire in the Dekhan. That, in its turn, seems to have been more or less due to its own natural decline aided by foreign invasions both from the north and from the west under the Sakas and others. The Andhra viceroys of the south-eastern frontier seem to have showed enterprise and pushed themselves southward and took into their territory the region dependent upon Kanchi, which continued to be a Chola viceroyalty even when it was under a Tondaman chieftain. The advent of this new power into Kanchi seems to have dislocated the people, Kaḷavar inhabiting the region of Vellore, and the North Arcot District in part, and it is their movement as a tribal movement that seems to have upset the territory of Kanchi first, the Chola kingdom next and even the Pandya kingdom afterwards. This seems to be what is actually referred to as the coming of the Kaḷabhras in the later Velvikuḍi charters of the

Pandyas. This introduces a period of about two centuries of confusion, during which the Pallava interlopers were able to occupy the territory of Kanchi and consolidate a kingdom of their own there. It was almost about the same time that the Pandyas after an eclipse re-emerge into light. The eclipse in regard to the Cholas seems to have continued. The territory having been divided among a certain number of Kaḷavar chieftains of whom we seem to hear of one family ruling in Puhar, or Kaveripattinam, one capital of the Cholas, another somewhere near Tanjore, almost at Tanjore itself, and a third in the State of Pudukottah at a place called Koḍumbāḷūr. It is by defeating one of these Tanjore chiefs that the later Chola dynasty established itself. When, about the commencement of the seventh century, the Pallavas had established themselves masters in Kanchi, and the Pandyas restored themselves to some considerable extent in their own territory, there sprang into view, simultaneously, a new power in the region of the Andhras. That territory, having been appropriated by a number of subordinate ruling

families under the Andhras, passed by quick transition into the possession of an important and influential dynasty known to history as that of the Vākāṭakas of Berar. These were the exact contemporaries of the great Gupta dynasty of Hindustan, and like that dynasty, these came to an end about the middle of the sixth century, and, giving place to a number of other dynasties, divided the territory among themselves. The dynasty that actually brought about this overthrow of the Vākāṭakas seems to have been the Chāḷukyas, who acquired a part of the territory directly dependent upon the Vākāṭakas in the north, gradually extended southwards and till about the close of the sixth century, they came into possession of what is now called the Southern Maratha country in the possession of the Kadambas, and thus came into touch with the Pallavas of Kanchi, set over against them in a south-easterly direction. From about A.D. 600 therefore these neighbouring powers show themselves to be rivals constantly fighting along their common frontier and carrying on the war to the uttermost extreme. During the period when the Chāḷukyas were thus emerging into

existence, the Pallavas extended their autho
southward till they actually extended t
boundary to the river Kaveri, so that the Ch
kingdom formed a part of their own territ
Thus consolidated the Pallavas showed th
selves the equal of the Chāḷukyas, and du
the period during which the two dynas
existed, they continued the wars constantly
if nothing could settle the question finally ex
the extinction of the one or the other pow
The Pallavas called themselves early Trai-r
Pallavas, that is, that they were a single po
of the south, claiming authority over the t
kingdoms, the Chera, Chola and the Pan
At this period, India falls into three divis
constituting almost three empires : (1) the em
of Harsha in Hindustan, extending up to
Vindhyas ; (2) the empire of the Chāḷu
under Pulikesin II extending from
Vindhyas to the frontier of the Krishna Tu
badra ; and (3) Tamil India under the domin
of the Pallava king, Narasimhavarman
Kanchi. That was the state of political div
when Hiuen T'sang travelled in India
came as far south as Kanchi.

e period of the great Pallavas extending about A.D. 600 and lasting on to the last er of the ninth century may be counted the d of Pallava dominance in South India. Pallavas stood forward as the representa- of the south against the aggressions of the kyas, who, in their invasions of the south, the earlier stages no further motive than f securing possession of their conquest in uthern part of their dominions. When that unfavourably and the Chāḷukya power aid low in dust almost by the destruction ir very capital under the greatest of their , Pulikesin II, their invasions of the south on the form of an effort at uprooting the as and asserting their authority in this as well. In this great struggle between o powers, the fortunes of war varied, and tely the Pallavas managed to maintain ground, and the Chāḷukyas passed out of ce after about a couple of centuries. The as therefore may be regarded during this as *the* power in the south against the kyas, whose ambition may be described as nquest of the Tamil land itself.

The Pallavas, like their contemporaries the Chāḷukyas, while having to do a good deal of fighting had not neglected the arts of administration and the promotion of learning and culture. It is to this age of the Pallavas that we are indebted for a large number of South Indian temples, cave as well as structural, most of the principal shrines having come into existence then, or, being already in existence, had been put on a more prominent or exalted footing. With the coming in of temples and temple building, came also the practice of giving donations and gifts to these temples and to Brahmans, and the period is remarkable for the large number of copper-plate charters as well as some stone inscriptions. There are records besides which give us an idea of the large number of works of public utility other than the building of temples and the settlements of Brahmans called *Agrahāraṣ*. These latter had for their main purpose the promotion of learning and research, such as the Bahur plates give indication of. Learned Brahman families were got together from great distances and settled in salient points with the proverbial house

and the normal tenement of an acre and a half of land for the maintenance of the family, so that these learned Brahmans may prosecute and develop their learning in peace, if not in plenty. The records give an insight into the existence, and maintenance of roads, the construction of large tanks and irrigation channels, the provision of a service of ferries and other public needs.

Kanchi had an early reputation in Brahman literature as one of the seven holy cities, and it had a wide reputation as a *Ghaṭika*, or settlement of Brahmans and a centre of Brahmanical learning. It is no less famous as a Buddhist centre as well as a Jain. Though occasionally there were controversies and disputations of a serious character among the votaries of these different religions, the normal state seems to have been one of peaceful pursuit of life, each according to his light. The age of the Pallavas witnessed the output of the far greater part of the religious literature of the Tamil land. The poems embodied in the *Vaiṣṇava Prabhandas* and the hymns of the Saiva saints were produced in this age. The royal family counted among

them Saiva and Vishnu devotees who devoted great attention to the promotion of learning. All of them, generally, took some pains to promote Sanskrit learning. Some of the rulers themselves have been learned men. As a supreme example of this may be mentioned Mahendravarman whose accomplishments were very varied. He could write a Sanskrit drama or plan a cave-building, patronise musical treatises and many other things of the kind. He was not perhaps alone in this varied activity. Sanskrit learning seems to have flourished also, and it is hardly necessary to mention more than the fact that Bhāravi and Daṇḍin enjoyed the patronage of the Pallavas.

The charters give us a glimpse into the enlightened character of the administration as a whole, though the information that we can acquire from them is to some extent imperfect. It gives us already a foretaste of the administrative system which we are able to see in greater fulness from documents of the Cholas and the period immediately following.

When the Chāḷukyas went out of existence chiefly through the exertions of the Pallavas on

the one side and the feudatory Rāshṭrakūṭas with the Pallava alliance on the other, the relative position of the Pallavas and the rulers of the Dekhaṇ remained much the same. The first Rāshṭrakūṭa seems to have remained in alliance with the Pallavas. His successor was otherwise busy creating trouble for himself on this frontier. But very soon the policy changed. The succeeding rulers left the Pallavas at peace while they were engaged themselves in the north-east. This was the period of the rise of the Gurjara power in Rajaputana which had to maintain a contest against the rising power of the Palas under Dharmapala of Bengal. In the wars between these two for the possession of Kanauj which at the time had become a kingdom in a high state of decline, the Rāshṭrakūṭas had to intervene with effect. But even so the great Rāshṭrakūṭa ruler, Govinda III, had to pay some attention to the south and more to the east where the eastern Chāḷukyas, the cousins of the rivals of the Pallavas, were rising in sufficient importance to exercise important influence in the politics of the Dekhan. The great achievements of the

Rāshṭrakūṭas in the north, notwithstanding, their attention was often turned to the south to keep the Ganga frontier safe on the one side and the eastern Chāḷukya frontier on the other. It was the rise of a new Chola State in the region of Tanjore that ultimately brought about the downfall of the Pallavas.

From the accession of the great Nandivarman Pallava Malla at the commencement of the eighth century, the Pallavas had to maintain a struggle in the interior against the partisans of the rival and the more legitimate claimant to the throne. They had similarly to fight constantly against the Pandyas as the head of the Tamil powers now, as there seems to have been all the time that the Pallavas existed, a considerable amount of some kind of jealousy between the Pallavas and the Tamil kingdoms. In the face of the Chāḷukya enemy, these Tamil powers sometimes joined the Pallavas and more than once, they were able to roll back the tide of Chāḷukya invasion from the banks of the Kaveri successfully. The accession of Nandivarman created a new position and the Pandyas as the really most important power at the time

made an effort to reap the greatest advantage from the change. As the power of the Chāḷukyas declined, the Pandyas took advantage of it to make an advance northwards, take possession of Kongu and extend their influence over the territory of the Gangas, the Pallavas more or less countenancing this effort after a period of struggle to prevent them from doing it. In the process of establishment of the Rāshṭrakūṭa power, this frontier was left at peace, but the Pallavas remaining in alliance, the Pandyas were able to establish themselves in a position of some considerable importance. When, in their turn, the Rāshṭrakūṭas became aggressive on this frontier, the Pallava-Pandya alliance seems to have continued for two or three generations more. The policy of the Pallavas seems to have undergone a change or it may be that of the Pandyas, the reason for which has not become quite clear. The Pallavas and the Pandyas are seen fighting on the banks of the Kaveri and the Gangas that were allies of the Pandyas are now seen to be subordinate to the Pallavas. It is in the struggle against the Pandyas that the Pallava power suffered a vital

injury. Advantage of it was taken by the rising power of the Cholas. The Pallavas under Aparājita suffered a crushing defeat from the Pandya Varaguna II near Kumbakonam. But there remained enough of the Pallava power to turn back the Pandya aggression from the frontiers of the territory of Kanchi proper. When the rising power of the Cholas established itself in Tanjore, and this must have been at the expense of the Pandyas, they felt sufficient confidence, and one of the earliest achievements was to deal a death blow to the Pallava power and annex the territory of Tondamandalam to their own dominions and give it a new name Jayamkondacholamandalam. This took place about the end of the ninth century and Kanchi thereafter became the capital of the Chola territory of Jayamkondacholamandalam. With that began the consolidation of the Chola power and the first great Chola, Parāntaka I by name, came to the throne early in the tenth century, carried his arms successfully against the Pandyas, extinguished the Pandyas as an independent power and seems to have effected a conquest even in Ceylon. With him the Pallava

power vanishes out of view and the kingdom of the Cholas stands established in full vigour as the dominant power in Tamil India.

The period of Parāntaka corresponded with the struggle of the Rāshṭrakūṭas against the rebellion within their territory by the scions of the Chāḷukyas, whom they themselves overthrow. It is this opportunity that was taken advantage of by the Cholas to lay the foundation of their power well and truly, and Parāntaka stood forward as the leading Tamil ruler in the south. With him begins the Chola empire which lasted for almost four centuries, not merely the dominant Tamil power but the dominant power of South India, which extended its authority practically over the whole of the Madras Presidency with a dominant influence over the kingdom of Kalinga and having among their records a successful effort at defeating and bringing into alliance, if not into allegiance, the territories of Bengal and Bihar up to the Ganges. The kingdom established by Parāntaka had to stand its ground against its enemies, the Gangas and the Rāshṭrakūṭas. In the struggle the Cholas suffered a temporary eclipse.

Under Rājarāja the Great, the Chola power emerged more brilliant than ever before and maintained itself in that brilliancy for a little over a century under five generations of five great Cholas beginning with himself and ending perhaps with Vikrama Chola, the son of Kulottunga I. This is the period when the Chola empire reached its zenith of glory and brilliance, in their extensive conquests no less than in the establishment of a beautifully well-ordered administration on absolutely modern lines. The period was also remarkable for the promotion of the arts of peace and the prosecution of those magnificent public works, which are the admiration of engineers in the Kaveri Delta. The administration grew somewhat feeble for two generations but revived under another Kulottunga, Kulottunga III. He beat back a great invasion from Ceylon under Prabhakarabahu the Great, and re-asserted the Chola authority over the kingdom of the Pandyas. With his successors came a Pandya revival and the Pandyas were able to wreak their vengeance upon the Cholas for the crushing defeat and insulting treatment that they suffered at the

hands of Kulottunga III. In this struggle the Chola power was maintained for a short while by the intervention of the Hoysalas from across the frontier in the north-west to succumb ultimately, the Pandyas taking their place as the leading South Indian power. The Pandya revival lasted throughout the whole of the thirteenth century and could count in this period one or two of the greatest rulers of South India. Their territory was so extensive, the spoils of war so great, the administration so efficient, that one of them Jatilavarman Sundara Pandya I could weigh himself against gold, sitting on the back of his state elephant of the best size and give to the temple of Srirangam which had suffered neglect and some destruction at the hands of the Hoysalas, $18\frac{1}{2}$ crores of gold pieces for the restoration of the great shrine. There was an unfortunate civil war between the rival claimants to the Pandya throne at the commencement of the fourteenth century, when Malik Kafur, the general of Ala-ud-din Khilji was knocking at the gates at the northern frontier, which opened the way for his entry into the Tamil land and thus introduced the first

wedge. Malik Kafur's invasion was a great plundering raid and the garrisons that he planted in salient places were turned out of the Tamil country by the enterprise of a ruler of Travancore, Ravivarma Kulasekhara, who carried his arms successfully as far north as the town of Nellore and even the frontiers of the Krishna and re-established Hindu rule.

The Hindus even at this distance were not destined to live long in peace. The achievements of Ravivarman Kulasekhara could but be of temporary effect. Muhammad-bin-Tughlak, when he had established himself on the throne and made himself master permanently of the Dekhan, carried his arms into the distant south and about the date A.D. 1335 could claim possession of an empire bigger than that ever enjoyed by the great Mughal Emperor Aurangzeb and almost as great a one as the British now enjoy to-day if Burma be kept out of the reckoning. The empire was no sooner established than its dismemberment came through defects of personal character of the monarch as well as the insane cruelty which often took possession of him against insubordination, real

and fancied. This Muhammadan governor of Madura tried to found a dynasty in the capital of the Pandyas, which lasted through a succession of about half a dozen rulers and it is the turning out of this garrison from Madura and a similar one in Cannanore about six miles north of Srirangam in the capital Hoysalas, that proved the crucial achievement that laid the foundation of the Hindu Empire of Vijayanagar.

It was to the credit of the self-sacrificing great Hoysala, Vira Ballala III hitherto regarded by historians as a pusillanimous coward, who abandoned his capital for the shelter at Tiruvannamalai, that this foundation was beyond little doubt due. There is record of a series of successful efforts progressively extending his power so far as to evoke the remarks of a Muhammadan historian, that his was an effort to surround the Muhammadan garrisons in the south and stifle them. He achieved great success, but fell in the fight in a great battle at Trichinopoly, victory in his hands, in one of these unlucky enterprises when he was surprised and taken prisoner by a small body of Muhammadan cavalrymen. He was put to death, and

that death had been more than avenged by the successor of the Muhammadan Sultan having been similarly put to death, and the territory of Madura taken from the hands of the Muhammadans by Prince Kumara Kampana, the son of Bukka, so far counted one of the two brothers, who are associated with the foundation of the Vijayanagar Empire. Vijayanagar was a foundation of Vira Ballala, though not called by that name, and five brothers, as officers set by him along the northern frontier against the rising kingdom of the Bahmani Sultan in Gulburga, ultimately succeeded where their masters failed, and Vijayanagar State was established at the end of the struggle, in which Vira Ballala lost his life. Bukka's achievements through his son Kumara Kampana marked for the time the recovery of India south of the Krishna for the Hindus and the establishment of Hindu authority there. It was fittingly signalised by the restoration of the Sriangam temple, which had suffered considerable damage at the hands of the Muhammadans, who had established their garrison at Cannanore, and the complete rebuilding of the temple at Madura

which had been thoroughly rased to the ground and destroyed by fire in the invasion of Malik Kafur and others that followed him. It is further as a result of this, that the succeeding ruler of Vijayanagar, another son of Bukka, Harihara II, established himself unquestioned emperor of the Hindus in the south. This empire lasted for two centuries and a half, the glory and admiration of travellers from afar, whether the traveller came from Central Asia or Europe. It consolidated not merely the Hindu territory in the south, but made a strenuous effort at conserving all the elements of Hindu culture which were suffering destruction beyond recovery, and such of the remnants of the Hindu learning and culture which we find in this part of India to-day, more orthodox perhaps even than the orthodox Aryan land of the north is due to the magnificent newly founded empire whose one preoccupation was to keep the Muhammadan neighbour of the Bahmani at arm's length from the northern frontier from the point of view of war. Its rulers found time nevertheless to pay some attention to the arts of civil government and human progress, to

such an extent that it proved to be an age of prosperity, which compared favourably with the countries of Europe and even with the great Holy Roman Empire. It was regarded as no less by travellers from Central Asia coming from the great kingdom of Samarkhand. Four dynasties of these rulers held rule with the normal incidence of usurpation and even civil wars, but on the whole they were able to maintain themselves in efficiency and prosperity notwithstanding the constant wars against the Muhammadans. One great weakness which they probably inherited from their predecessors was that they did not show the enterprise, that they showed in other departments, in the building up and maintenance of a navy. Naval enterprise was not altogether foreign to the Hindus ; they seem to have been efficient navigators pretty early in their history. Their colonies extended to the islands of the east and went across into the continent, and by way of land South Indian influence may be traced almost up to the frontiers of China, not far from Canton. The civilization of these regions is in many respects Indian civilization, Brahman and Buddhistic,

the earlier seems to have been due to South Indian influence and the later to North Indian, and all these could not have been achieved, and regular communication with the distant lands maintained without the possession of a navy. The Pallavas had their flotillas which could carry armies across and hold their own against the naval power of the Sailendras of Sumatra and later on of Java. The Pandyas seem to have had also, as there is record, at least won a great war against the kingdom of Sri Bhoja. The Cholas showed themselves to be a terror to the very same power and inflicted upon them, when they were the most powerful, a crushing defeat. The passing away of the Chola power and the re-establishment of the Pandya dominance coincided with the advent of Arab enterprise, and gradually and peacefully Arab nautical enterprise superseded that of the indigenous. This supersession had the effect of making the nautical people of South India gradually give up distant enterprise on the seas, and this contributed directly to the Islamisation of the Islands of the Archipelago. It is this gradual and peaceful supersession of the Hindus

by the Arabs on the sea that seems to have tainted the otherwise vigorous policy of Vijayanagar and in all that we hear of their constructive efforts we fail to notice an effort in this direction notwithstanding the fact that their territory enjoyed the prosperous trade of as many as 300 ports. With this came in a new influence. The Portuguese rounded the Cape of Good Hope and effected their first settlement in the West Coast of India. This introduced a new element, and we find the struggle of the Portuguese on the sea against the Arabs and Turks, and not against the Hindus of Vijayanagar. Notwithstanding that the very prosperity of the Portuguese depended upon the prosperity of Vijayanagar, and when Vijayanagar fell ultimately before the combined armies of the Muhammadans of the Bahmani kingdom, it had been all along a standing menace to their existence, the prosperity of the Portuguese vanished, though this was not the sole or the exclusive cause that brought about the destruction of the Portuguese prosperity. The Empire of Vijayanagar broke up chiefly through the sustained efforts of the two southern

Bahmani kingdoms, Bijapur and Golkonda, which through half a century of struggle pulled out of the empire bits of territory till the emperor was left without an empire. It was this emperor who confirmed a charter given to him by his immediate predecessors six years before and engraved in letters of gold that charter which laid the foundations of the British power in this part of the country ultimately to blossom into the British Empire in India. What was left of the empire was the kingdom of Mysore and a number of chieftancies, in what is now Mysore and the west coast set over against it, a great viceroyalty at Madura, the viceroyalty at Tanjore and the governorship of Ginjee. Whereas near the headquarters there was the Governor of Kalahasti from whose territory it was and through the good offices of one of its rulers that the East India Company agents, Coggen and Day, secured a charter which laid the foundations of Fort St. George. The history of Fort St. George has already been told by Mr. Dodwell for the *1922 Handbook of the Indian Science Congress.*

I may with advantage bring this history of

South India to a close with a brief narration of the other Hindu States which emerged from the empire of Vijayanagar. When the last great emperor passed out of existence about the year 1677, the viceroyalty of Madura cherished the ambition of extending its conquests, and got into hostility with the kingdom of Mysore which had been already founded and which had time to establish itself on a fairly firm footing. In the previous generations, a civil war took place among the feudatories, which disabled both Ginjee and Tanjore to such a great extent that they fell an easy prey first to the invasion of Bijapur and subsequently to Maratha invasions, so that these two were the only two powers which were left in the last half of the seventeenth century and the first third of the eighteenth. Mysore and Madura fought against each other and wore themselves out in the struggle. Mysore had still time to extend herself gradually to appropriate the whole block of territory which now belongs to her and even more on the borderland. The usurpation of Hyder Ali put an end, for the time, to Hindu rule till it was restored by the British at the

commencement of the nineteenth century. The viceroyalty of Madura came to an end in 1773 through the progress of the newly created Nawabship of Arcot under the great Mughal Nizam-ul-Mulk, who established himself independently in the Dekhan when the Mughal Empire broke up. The Muhammadan conquest of Madura proved temporary and, through varying fortunes, the British finally established themselves as rulers of the territory of Madura and laid the foundation of the Presidency of Fort St. George, almost about the time, just a few years later when they overthrew Tippu Sultan and restored Mysore to the scion of the Hindu dynasty from whom Hyder Ali took it. This marks the foundation of the Madras Presidency and the establishment of British rule in this part of the country.

S. K. A.

THE CITY OF MADRAS

MADRAS like its sister Presidency towns of Calcutta and Bombay and like the vast British Empire in India of which it is the third city in population and wealth is the offspring of the fruitful union of British enterprise and Indian co-operation. But unlike Calcutta or Bombay, Madras started with no natural advantages in its favour. It has unlike Calcutta no fertile hinterland watered by two mighty rivers, the Ganges and the Brahmaputra, nor unlike Bombay has it a fine natural harbour at the gate of India to do trade with the civilized countries of the West. What Kipling says of Calcutta 'chance directed, chance erected' is less appropriate to her than to Madras. The site on which Madras was built was selected by chance on sand thrown up by the sea and the town was built on an exposed sea coast subject to violent storms and surrounded by districts not naturally

very fertile nor possessing mineral resources. As the hearth and the cradle of the British Empire in India possessing a population industrious, intelligent and above all, very level-headed, Madras played a very important part in the early history of British India.

The first factory established by the English in South India was at Masulipatam which was then the seaport of the Kingdom of Golconda but the first fortified settlement of the English in South India was at Armagon. Francis Day, the chief of Armagon, finding this place unsuitable for trade went southwards in search of a site for a new settlement and obtained from the Naick of Poonamallee permission to establish an English settlement at Madras. This was in 1639. This grant was soon after confirmed by the scion of the royal house of Vizianagar settled at Chandragiri. The settlement thus established about three hundred years ago has now grown into the third city in the Indian Empire. Madras at the last census had a population of 528,791, and the area included within the municipal boundary is about twenty-seven square miles, the extreme length of the city

from north to south being about nine miles, and greatest breadth east to west about four miles. Till not very long ago, this big and historic city looked like a collection of scattered villages. Even now its beautiful houses hid among the large trees in the spacious gardens surrounding them offer amenities to their dwellers denied to those living in any other city in India.

The municipal affairs of the city are managed by a Council and a Commissioner. The Council consists of fifty councillors of which thirty are elected by the ratepayers of the thirty municipal divisions, eleven by various institutions and nine are nominated by the Government. There are four standing committees of seven members each dealing with taxation and finance, works, health and education. The Commissioner, who is a Government officer and who is appointed by the Government, is the head of the executive. Each year in November, the Council elects one of its members as President. The three principal officers of the Corporation are the Revenue Officer, the Health Officer, and the Engineer, who are appointed by the Council subject to confirmation by the Government.

The income of the municipality is inadequate to meet the demands for amenities which a city population even in an oriental country has learnt to make and with its high rates of mortality, inadequate water-supply, defective drainage, Madras has to travel a long way before it approaches anywhere near the standard of municipal administration set up by many of the cities of the West. But there can be no doubt that within the last few years, some improvements have been noticeable and the 400 miles of streets are better maintained and better lighted and the beautiful Marina which is the pride of Madras and the envy of all other cities of India has grown more beautiful of late years. An endeavour is also being made to remove congestion, to clean the paracheries and to settle the surplus population of the town on what were till recently suburban areas.

The revenue administration of the town is in the hands of the Collector who performs a number of duties, some of which are different from those which the Collectors of other districts are called upon to perform.

The Madras harbour is a monument to the

genius of British administrators and British engineers. Nature having done nothing for the provision in Madras of any kind of shelter for shipping, an artificial harbour had to be built by enclosing a part of the open sea by walls to provide for the trade of a capital city. The harbour as described by its creator was 'a challenge flaunted in the face of Nature' and this challenge is sometimes met by Nature in a manner which is disastrous to the shipping in the port. A nine acre boat basin serves for the safe anchorage of all small craft from 1,000 tons downwards working in the harbour. It is equipped with 1,690 feet of shallow quay wallings alongside of which barges and cargo boats can lie. A canal from the boat basin leads into a two acre timber pond. The port is provided with piping through which oil and petrol may be pumped into installations from vessels lying at the moorings. Horses and cattle can walk straight ashore into or embark from paddocks without the intervention of railway wagons. The West quay provides berthing for four and in an emergency six vessels of 26 to 30 feet draft. There are three other ship quays, viz.,

the Outer quay, the East quay and the South quay.

Beyond the harbour, a short distance to the south of it, begins the beautiful Marina to which allusion has already been made. It is a beautiful promenade about three miles long stretching to San Thome. On the western side of the promenade are a number of public buildings, the Senate House, the Chepauk Palace (Office of the Board of Revenue), the Public Works Secretariat, the Presidency College and Queen Mary's College for Women. To the east on the sea is the Aquarium which is the only one of its kind in India.

Madras being a city of gardens, the public gardens do not attract so much attention as they would otherwise do in a closely built city. Mention must, however, be made to the Agri-horticultural Gardens on the Mount Road and the People's Park with the Zoological gardens in it.

Madras is the terminus of two railway systems, viz., the Madras and Southern Mahratta Railway and the South Indian Railway, though the headquarters of the latter

railway are at Trichinopoly. The former which serves the north and the west of the Presidency has its terminus at the Central Station and the latter which serves the southern part of the Presidency has its terminus at Egmore. These two railway companies manage 5,231 miles of railway between them. Of late rapid extensions are being made in railway construction. The city itself is served by the South Indian Railway from the Beach to Chetput and beyond to suburban areas which are opening up towards the south.

Besides the railway, the town is served by electric trams and motor buses which are capable of much improvement in appearance, comfort and service.

Madras is proud of its educational institutions and this is as it should be, it being the capital town of the most literate province of India. Of the four Indians who have been Fellows of the Royal Society, two hail from this Presidency. The University of Madras was founded in 1857 and its constitution was considerably changed in 1904 and 1923 and further changes are in contemplation. It is still mainly an examining

and supervising body but its examinations are the stiffest of any University in India. If it lacks the culture and the wider outlook on life of some of the Universities of the West, if it has yet failed to create the atmosphere which the genius of Sir Ashutosh Mukherjee created for the Calcutta University by affording facilities for scholarship and research and bringing into existence a band of young men with European reputation for original work, the University of Madras has none the less done solid work to spread education and its alumnii are to be found all over India engaged in work requiring intelligence, industry and honesty of purpose.

Within the city of Madras, there are eight Arts and Science Colleges and also the Medical College, while in the suburb of Guindy is the Engineering College. Of the Arts and Science Colleges, the Presidency, the Pachiappa's and the Christian Colleges are the oldest and the Loyola and the Women's Colleges are the latest. What strikes a stranger in Madras is the spread of a workable knowledge of English among the lower strata of society in this town. A stranger

who knows English has no difficulty in finding his way about and transacting his business in this city, while in other cities of India a knowledge of the local language or at least of Hindustani is essential.

Madras is fairly well supplied with hospitals and some of these institutions attract students from other parts of India. This is specially the case with the Maternity Hospital, which is the best of its kind in India. The General Hospital requires better accommodation and equipment to do efficiently the work it is called upon to perform and large improvements and extensions are under contemplation. Besides the General Hospital, there are two other big hospitals one at Royapuram and the other at Royapettah with 354 and 100 beds respectively. There are also the Mental Hospital at Kilpauk, King Edward VII Tuberculosis Institute and Hospital at Egmore, Government Ophthalmic Hospital at Egmore, Government Hospital for Women and Children at Egmore, Government Victoria Hospital for Women at Triplicane, Raja Sir S. Ramaswami Mudaliyar's Lying-in-Hospital at Royapuram, Kalyani Hospital in

Mylapore, besides several dispensaries maintained at public cost. There is also a Veterinary College and Hospital at Vepery.

No account of Madras will be complete without a mention of its lawyers and its law courts and legal institutions. The fame of Madras lawyers both as judges and as legal practitioners has spread to other provinces of India: No province of India has produced a sounder judge than Sir T. Muthuswami Ayyar or a more profound lawyer than Sir V. Bashyam Ayyangar. The High Court and the Law College are imposing buildings in the so-called Indo-Saracenic style on the Esplanade not far from the Beach. The High Court has fourteen judges including the Chief Justice and the Law College has a Principal and twelve lecturers and the number of students on its roll last year was 897. Besides the High Court, there are the City Civil Court and the Court of Small Causes for the disposal of civil disputes and there are four stipendiary Presidency Magistrates and over 100 Honorary Magistrates for the disposal of criminal cases arising in the city.

To the north of the Esplanade lies the

business quarter of the town. The various banks and merchant houses are there. In Mount Road and in its vicinity are many shops, European and Indian, doing retail trade and some hotels.

Of the sights of Madras, the first and foremost is the Marina with its Aquarium of which mention has already been made. On the Fort Beach is marked the spot where the shell from the 'Emden' fell during the late war which caused a panic in Madras. The Fort which also contains the Secretariat and some other public offices and the Legislative Council Chamber is also well worth a visit. In it is St. Mary's Church which is the oldest Anglican Church in India opened for worship in 1680. It was in this Church that Clive was married. The other important places of Christian worship are the Cathedral Church of St. George in Teynampet opened and consecrated in 1816, St. Andrew's Church in Egmore dedicated to service in 1821, the Roman Catholic Cathedral (the Church of St. Mary of Angels) in Georgetown under the Archbishop of Madras and the Cathedral in San Thome under the Bishop of Mylapore.

Of Hindu temples there are two fine specimens —Sri Parthasarathi Swami temple at Triplicane and Sri Kapaleeswarar temple at Mylapore. These are of the usual Dravidian type of architecture though they do not come up to the standard of those colossal temples, which are the pride and glory of South India, met with in Madura, Srirangam, Tanjore, Chidambaram, Conjeevaram and various other places. Except Egypt and the old Hindu colonies of Java and Cochin China, no other country in the world can show such stupendous ancient monuments containing such exquisite carvings as these temples of South India. Compared with them, the temples of some of the holiest places in the north like Benares, Muttra or Brindaban are quite puny structures devoid of any architectural beauty.

The principal mosques in the town are the Wallaja Mosque and the Anwari Mosque.

Besides the University library, there are two other important libraries in Madras, viz., the Connemara Library and the library of the Literary Society. Opposite to the Connemara Library is the Museum and on the same road is

the Victoria Technical Institute. Mention has already been made of the Senate House and the Chepauk Palace on the Marina and the High Court and the Law College on the Esplanade. The Ripon Buildings, where the offices of the Municipal Corporation are located, the Victoria Public Hall and the Moore Market are clustered together at the entrance to the People's Park in the vicinity of the Central Station and the offices of the Madras and Southern Mahratta Railway. The Prince of Arcot lives at Amir Mahal, a palace in Triplicane.

Madras though one of the oldest of British settlements in India is yet young in spirit. Great as has been her contribution in the past to the work of founding and consolidating the British Empire in India, she aspires to greater achievements in the future. Her greatest asset is her population industrious, intelligent and law-abiding. In the chapter of Indian history that is now opening, Madras aspires to play a very important part. As in the past so in the future, her contribution though not showy is bound to be solid. She will not be swayed by blind passion. She will do nothing in haste.

In the past, the genius of her people found expression in literature and in temples and in works of irrigation. In the future, she will build stone upon stone, brick upon brick, on sure and solid foundation, till she remodels her society and body politic following the peculiar bent of her genius.

MADRAS CITY ARCHITECTURE

Introduction

This article has been written at short notice without reference to authorities on the subject. It does not profess to be historical although the buildings referred to have been divided into Periods for these periods refer rather to character than to time of construction. It professes to be a somewhat superficial description and criticism calling attention to what is interesting and good and thus helping to create a sound judgment in architectural matters. It is necessarily short and unreasoned. A word of explanation is necessary in view of the several references to architectural styles, as good architecture need not necessarily conform to any of the recognized styles. In Europe to-day many fine buildings, architecturally, are being constructed in the designing of which the historic

styles have been entirely discarded in an effort to get back to first principles. The styles are of value, as adherence to principles and proportions on which they are based is likely to produce good architecture as these principles have been developed over a number of generations of trial and error in which the material available, climatic conditions and customs of the country have had due consideration. But new materials demand new methods and new customs require re-adjustments and departures from tradition. Architecture is not a matter of superficial decoration but is bound up with the building itself and fulfilment of its purpose in the most efficient manner. 'Architecture' says Professor Lethaby, 'is the art of building and disposing of buildings. Good architecture is masterly structure with adequate workmanship; the highest architecture is likely to have fit sculpture and painting integrally bound up with it'.

In order to appreciate at their true value the buildings in Madras a short general criticism is necessary. Madras, like so many other cities, suffers from the fact that, during the period of

its greatest expansion and structural activity, Town Planning, the art that relates a building to its surroundings, was not practised otherwise in view of the number and variety of notable buildings, instead of being a disappointing city, architecturally, it might have been most attractive. It was a city of great possibilities but the formal dignity and monumental character which one naturally and reasonably associates with a capital city are almost entirely lacking. In this respect there is considerable similarity with most Capital Cities in the British Empire. It is natural that the administrative centre of a large State should reflect in the lay-out of its streets and the character of its buildings, the majesty and dignity of Government for it cannot be doubted that such characteristics in the Capital City would have a beneficial influence on the community and help to develop a sense of national consciousness and civic pride and responsibility.

It is almost impossible to point to a building of any importance in Madras, the placing of which in relationship to its surroundings, has been properly studied. This is typical of cities

of the British Empire and is, no doubt, partly due to the earlier development of democratic Government ; for whilst princes and potentates in other parts of the world were still planning their towns with the palaces as the focal centre of civic life, democracy had already put a check on the expanding activities of ambitious princes in England and its Dominions. The contrast can be seen in India between some of the Capital Cities of Indian States and the Capitals of the Presidencies. The former, although on the average much smaller, are much more the average man's conception of what a Capital City should be.

Paris is the Capital City par excellence owing to the fact that so many of its buildings of importance are placed in studied relationship to their surroundings either as terminal features to street vistas, or as parts of harmonious architectural street schemes or as in the manner in which they have been grouped around some public place or square. Buildings architecturally mediocre acquire dignity and grace if they are placed in harmony with their surroundings.

A few examples of this failure to relate buildings to their surroundings may be quoted :—

(1) Government House presents an array of clerks' quarters, garages and godowns to the gaze of the man in the street instead of an imposing facade approached by broad avenues ;

(2) The long frontage of the High Court is set at an angle to China Bazaar and has no relationship to it whilst part of the frontage of this most important street is occupied by buildings of an insignificant nature ;

(3) The Museum, Connemara Library and Theatre instead of standing in complementary relationship to each other impressively arranged round a public court or garden stand rudely in front of each other ;

(4) The Victoria Institute might have been placed as a beautiful terminal feature to Monteith Road adding dignity to itself and to the road ;

(5) Chepauk Palace presents an unsymmetrical elevation to Wallajah Road not quite in axial alignment with it.

It would be possible to go on giving examples of this unfortunate characteristic but

enough has been said in explanation of the fact that Madras as a city is disappointing although it has all the necessary ingredients required in the composition of an impressive Capital. We are really better off than the casual visitor might suppose but our architectural display has been badly organized.

Buildings have not been included from their archaeological interest but in order to give a slight historical flavour to these notes they have been placed in four categories or sections as follows :—

(1) Hindu ;

(2) Early European Settlements (seventeenth and eighteenth centuries) ;

(3) Victorian (later nineteenth century) ; and

(4) Modern (twentieth century).

First Section—Hindu

In this section there is very little of note. Books on Indian architecture do not refer to any buildings in the city and no one, unfortunately, visits Madras to see the glory of its ancient buildings !

Mylapore Temple and tank is perhaps the best known Hindu building and Parthasarathi Temple and tank at Triplicane perhaps the most interesting. The latter is of very ancient tradition and much sanctity and is dedicated to Vishnu ; the former on the other hand is dedicated to Siva. The most noteworthy feature at Mylapore architecturally, is the unbroken flight of granite steps surrounding the huge tank, a bold conception recently carried to completion. The tank with its central island pavilion and the temple and palm trees in the background is one of the most pleasing pictures in Madras. The chief feature of the temple is a *gopuram* of good proportions and considerable size situated behind a smaller entrance *gopuram* the latter being with the outer wall, decorated in the usual manner in alternate red and white vertical bands.

Mylapore Temple.

Partha-sarathi Temple.

Early Muhammadan buildings have not been included as there are no buildings of architectural importance in the style but mention should be made of Shah Aulaiy's tomb, situated on Barbers Bridge Road between Triplicane and

Mylapore, a picturesque white domed building in the Indo-Saracenic style, a place of considerable veneration to Muhammadans.

Second Section—Early European Settlement

Of the buildings of the early settlement, in which I include those up to the early nineteenth century, St. Andrew's Kirk is probably the most noteworthy, architecturally, because of its unusual construction, a circular dome on a complete circle of twenty detached columns. It is situated on Whannells Road and Poonamallee High Road by Egmore Station and is a monument to the genius of Major de Havilland of the Engineers, the Christopher Wren of Madras, who was also responsible for the St. George Cathedral, etc. The Cathedral, like the Kirk, is a building of fine proportions in the English renaissance style. Both these buildings are finished externally and internally in the celebrated Madras chunam made from sea shells

St. Andrew's Kirk.

St. George Cathedral.

which weathers almost like marble. The internal columns in the Cathedral are fine examples of highly polished plaster. The Cathedral was finished in 1816 and the Kirk in 1821. Recently the apsidal east end of the Cathedral has received a handsome marble reredos. The Cathedral is on Mount Road about three miles from the Fort opposite to the Agri-Horticultural Gardens.

Government House.

Government House (Mount Road south of the Island) is externally undistinguished being without balance or substance, its main frontage consisting of three superimposed rows of attenuated columns with tatties between. The adjacent Banqueting Hall is however a building of distinction but badly placed with respect to Government House or appearance from the road. It was built by Lord Clive in 1802 to commemorate the fall of Seringapatam and is of classic style and detail. Unfortunately it has been surrounded with arched verandahs and balconies which are not in harmony with and put it out of comparison with the great classic buildings of the

Banqueting Hall.

world. Internally it is a finely proportioned columned hall enlivened by historic flags and oil paintings. The best views of Government House and the Banqueting Hall from outside the compound can be obtained from Adam Road on the south bank on the Cooum.

Fort St. George.

The buildings in Fort St. George naturally come within this period. The most interesting to the visitor is St. Mary's Church the subject of another article. The Accountant-General's Office opposite, once the residence of Clive may be mentioned for that fact and for its interesting classic facade. The Secretariat itself is a building of some size in the English Renaissance style but unfortunately its main facade is towards the west and the dignity that might have accrued to it, as the dominant building in the Fort facing the central square, is lost behind an irregular group of shade trees and a mass of unsightly sunshades, whilst other elevations are disfigured by inappropriate excrescences. Its western facade has been much improved recently by the addition of projecting wings at each end. The

The Secretariat.

building is also unfortunately somewhat marred by the false jointing in the plaster work which does not comply with the apparent structural requirements and by inconsistencies in the colour scheme. In front of the Secretariat is a pleasant classic stone canopy which once held the statue of Lord Cornwallis now in the Connemara Library.

Legislative Council Chamber.

On the east side of the Secretariat is the New Council Chamber which as an addition is mentioned here though it properly comes in the fourth or last section being added in 1910. The facade is noted for the twenty polished black granite columns, called Pitt's columns from the fact that they originally formed a colonnade from the Fort to the sea gate built by Governor Pitt. In 1746, when the Fort was captured by the French, these columns were removed to Pondicherry but were recaptured and returned in 1760!

The Council Chamber is a room of pleasant proportions finished in teak panelling and polished white plaster with a black and white marble floor and a fine plaster ceiling in high relief. The internal effect is somewhat spoilt

by the forest of fans; and the hangings and amplifier which have been found necessary to improve its accoustic properties. Unfortunately the building is located behind the great central bastion, the old sea gate of the Fort, and it is impossible to obtain a good comprehensive view of it.

There is no space to mention any of the other buildings in the Fort but it may be remarked that there is simplicity and harmony about the early work with its scholarly classic or Renaissance details but architectural deterioration has resulted from the many alterations and additions to which the buildings have been subjected.

Commercial Offices.

In addition to the buildings already mentioned, this period produced a number of commercial buildings of importance, some of which remain along the North Beach Road, and a large number of bungalows, some of them quite palatial, scattered about all parts of the city outside of Georgetown. Some of these are preserved very much in their original state, others have been altered out of recognition and some have fallen from

Company bungalows.

their original state. Special mention might be made of Doveton (School) Vepery, the Mohammedan College, Mount Road, Blackers Gardens and Newington, Mount Road, Rutland Gate, Bensons Bungalow (the Women's Christian College), The Albany, The Adyar Club, Brodies Castle, etc. There is also the Madras Club, the simple classic facade of which seen from Mount Road is given dignity by its location as the terminal of a vista of trees. In keeping with these are some of the bungalows and buildings in San Thomé and Mylapore of Dutch or Portuguese origin, the details and proportions of which were frequently particularly scholarly and pleasing.

Old Light House.

Of this period mention must also be made of the Old Light House finely built in granite in the form of a gigantic Doric column but now overshadowed by the High Court in the compound of which it stands.

St. Thomas' Mount.

The early Church at Luz (the earliest in Madras) and the ancient Churches at Little Mount and St. Thomas' Mount so intimately connected with the reputed life and death of St. Thomas,

should be mentioned here although they are of an earlier period. The Mount particularly should be visited by those who have time.

Third Section—Victorian Period

This era has unfortunately been writ very large on the architecture of the city and one fears the writing is almost indelible! Reference has been made to the architectural loss due to the failure to relate buildings to their surroundings and I must here refer to another unfortunate characteristic of the buildings in the city erected during this period, viz., the lack of harmony between adjacent buildings. In this respect there is a striking contrast to the architectural harmony that pervades the Fort and the domestic architecture of the early settlement period or the architectural developments in Georgetown and Triplicane where, except for modern additions and new buildings, a general harmony still frequently exists. This discord which Mr. Trystan Edwards, a well-known writer on architectural matters, calls 'architectural bad

manners' can best be seen along the North Beach Road, China Bazaar, the General Hospital and Poonamallee High Road, Mount Road and the Marina, the four main arteries leading from the Fort to the north, west, south-west and south.

The pleasing and appropriate traditions of the eighteenth century, whether Western or Indian, were discarded and a spirit of emulation was adopted with particularly deplorable results in a country in which building was comparatively cheap. Many of these buildings are the result of praiseworthy but generally unfortunate attempts at Indianisation. The buildings in the commercial area of Georgetown were in this respect generally much more successful than those in Mount Road. It would be difficult to find anywhere in the world a more depraved collection of incongruous and pretentious, architectural atrocities and absurdities than is strung out along the margins of Mount Road! Fortunately a number of the original avenue trees are still preserved to us or Mount Road would be appalling! One of the most prominent of these buildings is the block known as W. E. Smith's

but there is one thing to be said in favour of this block, that in plan it does take cognizance of the shape of the site and is designed to make the best use of the location.

General Post Office.

Of the buildings along the North Beach Road the General Post Office is one of the most interesting and attractive attempts at Indianisation. The lower parts of the building may be described as Dravidio-Gothic but in its upper parts it has a strong Teutonic flavour. Some of the details of the stonework in the lower floors are pleasing.

Banks.

Other prominent buildings are the Imperial Bank, National Bank of India, the Mercantile Bank of India, the Custom House and Collector's Office but particular mention must be made of the police station under the shadow of the National Bank, a charming little building and a very successful attempt to develop indigenous South Indian architecture, somewhat ornate and delicate perhaps for a police station which rather calls for boldness and severity.

North Beach Road Police Station.

Next door at Parry's Corner we find the frontage of what is probably the most valuable commercial site in the city occupied by garages and godowns!

Parry's Corner.

Rounding the corner into China Bazaar we are at once confronted by the amazing assemblage of domes and pinnacles, crowned by the Lighthouse, which covers the greatest centre of activity in the City—the High Courts. The building is in the Saracenic style although it might be more truly described as Indo-Gothic in many respects. The general impression owing to the multitude of domes is Eastern and much of the detail is Indian in character though of a somewhat mechanical nature. The most impressive and beautiful view of the building, and of others in the vicinity, can be obtained from the harbour arm at sunset. The silhouette of domes and towers against a tropical sunset, with the foreground of shipping and giant cranes, makes a picture to be remembered.

China Bazaar.

High Court

On the opposite side of China Bazaar is another medley of domes and towers—the

Madras Christian College. The late Dr. Miller, to whom the College owes so much and whose statue faces it from a little enclosure on the other side of the road, was a great builder with advanced architectural ideas. The several buildings composing the College are in a mixture of styles and no style in particular but the two-colour decorative scheme which is uniformly applied pulls the group together into a fairly harmonious whole. Dr. Miller has attempted, on a compressed scale and not without considerable success, to secure the wonderful architectural harmony in diversity which is seen at its best in the Colleges of Oxford and Cambridge.

Madras Christian College.

Of the other buildings in China Bazaar the Y.M.C.A. is worthy of notice. It is the nearest thing in Madras to a skyscraper, having as many as four floors! It is faced with beautiful pink stone in Indo-Saracenic style finely built consistently carried through.

Y.M.C.A.

The Law College on the opposite side of the road is in architectural harmony with its

neighbour the High Court and is one of the few examples of buildings (like W. E. Smith's just mentioned) which is arranged to suit the site as its main facade and entrance take cognizance of the important road junction which is the traffic hub of the city. Not far distant is Pachaiyappa's College which exhibits a pleasantly proportioned Doric columned facade to the road, the effect of which is spoilt by the fact that the beam over the columns, which takes the place of the architrave in the Grecian buildings is coloured blue whilst the rest of the entablature, of which it is a part, and the columns supporting it are white. This is the most common error in the finishing of the multitude of buildings in this city which are based on the classic orders. The unity of the order is spoilt and the sense of structural adequacy, which the eye unconsciously demands, is lost. In a building to the surface of which plaster and colours are applied the design, rather than the foundation material, should be the basis of the colour scheme.

Law College.

Pachaiyappa's College.

Pachaiyappa's have recently built an imposing and many domed hostel at Kilpauk the best view of which is that from the train on approaching Chetput station.

Several other important buildings of this period are stretched along the Marina going south from the Fort. The Senate House stands first in order. This is one of the most impressive buildings of the city, of magnificent mass and proportion in Indo-Saracenic style but with detail of somewhat unequal merit. It also should be seen at sunset from the sand by the mouth of the Cooum or by moonlight. If anything is needed it is a central dominant feature but even without it the building is a real tour de force.

Senate House.

Adjacent to it is the Chepauk Palace now the office of the Board of Revenue, etc., a picturesque building which in point of time belongs to our second period but in character it is more in keeping with the third, being a distinct and fairly happy effort at Indo-Saracenic. The fine central tower was added later and actually belongs to the third period and is a well proportioned and very

Chepauk Palace.

successful essay in the style. In continuation of the Palace is the large P.W.D. Secretariat, prominently placed on the roadside, a building lacking in style or character or anything to commend it, a sad lapse from the standard set by the Senate House and Palace.

P. W. D. Secretariat.

The next in order is the Government Presidency College, a building of considerable character and interest, reminiscent of French and Italian Renaissance, somewhat florid perhaps but in this respect true to the style. The brickwork of the modern extension has, unfortunately been redded over and is out of harmony with the pleasanter tone of the original building. The general appearance from the Marina is not improved by the prominent location of the gas plant !

The Presidency College.

Another prominent collection of buildings of this period can be seen along the General Hospital Road and Poonamallee High Road running westward from the Fort. The first is the Medical College, another unfortunate building of no architectural interest prominently placed. Adjacent

Medical College.

to the College is the General Hospital, a building of the second period but so hidden by trees, compound wall, out buildings and excrescences that the character of the original structure can hardly be appreciated from the road. The Hospital and College are now being reconstructed, enlarged and modernized at a cost of about 50 lakhs to the designs of Mr. W. H. Nicolls, F.R.I.B.A., late Consulting Architect. On the opposite side of the road is the magnificent new office block of the M. S. M. Railway, but as a modern building this will be discussed when we come to our last section. Next in order is the Central Station, a building of very considerable merit. The south facade and clock tower are well proportioned and interesting in detail but somewhat spoilt by the paltry cast iron railings and corrugated iron roof which are hardly in keeping with the remainder. In detail it is somewhat suggestive of Italian Gothic or early Renaissance.

General Hospital.

M. S. M. Railway Offices.

Central Station.

Crossing General Hospital Bridge we come to the principal market of the city,

Moore Market, a somewhat mechanical attempt at Indo-Saracenic of no great interest. This is followed by the Victoria Public Hall, a large building of non-descript style, dull and depressing, hardly worthy of its fine open situation in the People's Park. Adjacent to it but a great contrast in style is the Ripon Building, the Office and Council Chamber of the City Corporation, one of the largest and most impressing buildings in the city. It is Renaissance in character with a massive and well proportioned central tower. This building should in point of time come under our fourth period but it does not exhibit the more refined and scholarly characteristics which are associated with the architectural revival of the twentieth century. Its detail is uninteresting and does not merit close study.

Moore Market.

Victoria Public Hall.

Ripon Building.

Other buildings in the city of this period to be noted are the Museum, etc., in Pantheon Road. The most prominent and the least interesting building in the group is the Museum Theatre,

Museum and Library.

behind and attached to it is a part of the Museum. Behind this is the Connemara Library an interesting though somewhat flamboyant essay in English Medieval style, inspired, no doubt, by the great collegiate halls in English University Towns. Behind this again is the original Museum building a pleasant and refined example of the work of the earlier or second period. What an imposing group this would have been if they had been harmoniously designed and arranged on three sides of an open square facing the Pantheon Road. In the next compound is the Victoria Institute which will be referred to in the chapter on the fourth period.

Madras Literary Society.

A small building in College Road, Nungambaukam is worth a passing reference. This is the Madras Literary Society building in the compound of the Office of the Director of Public Instruction, a pleasantly proportioned and detailed building similar in style and character to the Police Station in North Beach Road already referred to.

The Roman Catholic Cathedral, San Thomé,

must be included in this period. It is a large building in fairly consistent but somewhat uninteresting Neo-Gothic style. The Cathedral is celebrated from the fact that the tomb, believed to be that of St. Thomas (who gives his name to the place) is located therein.

St. Thome Cathedral.

Madras has a fine Veterinary College in Indo-Saracenic style but very few visitors would ever see it unless they have business in Vepery.

Veterinary College.

Modern—or Twentieth Century

Madras is not rich in modern architecture but it has one building of this period of outstanding merit, the M.S.M. Railway offices already mentioned. This is a building of the highest rank of which any Indian city might be proud. It is altogether in a class by itself, a free and successful rendering of traditional indigenous details on a framework of fine and satisfying proportions in which the essential character of Dravidian work has been realized. At the same time it is an

M. S. M. Railway Offices.

entirely modern building designed to meet the requirements of a large office. The central staircase hall should be seen as it is a fine domed apartment running through two floors more Renaissance than Indian in detail. The architect, Mr. Norman Grayson, was fortunate in the opportunity given him and in being provided with a stone which is more easily worked than the usual harder granite of South India. If there is anything that one can criticise architecturally it is the numerous octagonal domes which are hardly in character with the remainder of the facade. From the civic or social point of view one may also question the propriety of a commercial office building, even of a Railway, being so much more imposing than the Office of the State and the Council House of the Legislature! From the Madras and Southern Mahratta Railway Office we will turn to Egmore Station, the terminal of the main line service of the S.I.R. To most people who depart from Egmore in the dark or who arrive in the morning at the unpretentious northern arcade a sight of the picturesque southern facade may one day come as a surprise.

Egmore Station.

This is a fairly successful effort to Indianize the details of an important modern building though whether it is appropriate station architecture is another matter. It is in a back street with no direct approach and has no relationship to its somewhat untidy surroundings otherwise it would receive the notice that it deserves.

Victoria Institute.

The Victoria Institute already mentioned is another modern building meriting attention particularly on account of its rich Indo-Saracenic detail, the beauty of which compensates for any weakness in proportion or scale. The building is of pink Tada stone and was erected in 1906 as a memorial to Queen Victoria, a really beautiful piece of work.

St. Anthony's Roman Catholic Church, Pudupet.

Not far away, in Marshalls Road, Pudupet, is St. Anthony's Roman Catholic Church just completed and well deserving. This may be said to be Byzantine in atmosphere and is of consistent design throughout. Of good proportions with a central concrete dome at the crossing and a most satisfactory tower, it is a building in great and pleasing contrast to the rather flamboyant Gothic

which one associates with the Roman Catholic churches of South India.

In the same neighbourhood are the Government Eye Hospital and Government Maternity Hospital buildings in no particular style though the entrance block of the latter is a pleasant piece of work.

Tuberculosis Institute.

Not far away on the Spur Tank in Egmore is situated the Tuberculosis Institute a small but well proportioned domed plastered building, Western rather than Eastern in detail, the first instalment of the New General Hospital that was to have been built on the Tank area.

Masonic Hall.

In the same district, but best seen from Graeme's Road on the other side of the Cooum is the fine New Masonic Hall, a monumental, dignified and finely detailed white plaster building, the work of Messrs. Jackson and Barker of Madras, the simple skyline of which is in great contrast to the frequently too fussy silhouettes to which one is accustomed.

In addition to the above there are a number of recent educational and medical buildings of

which Queen Mary's College on the Marina, the Industrial School on Broadway, Royapuram Hospital and the Willingdon Training College near the Marina might be mentioned.

Of modern commercial buildings, Madras has very little to shew the visitor. The Mercantile Bank of India on the 1st Line Beach is possibly the most important. This is a building of four floors in the English renaissance style which would look quite at home in the City of London but which has nothing about it suggestive of India or the Tropics.

As the architecture of Mount Road has been criticised somewhat severely mention should be made of buildings on that road which have some merit. There are the two small stone fronted buildings, opposite Government House, Indian in their composition and detail. Then there is the Government Press opposite W. E. Smith's, a pleasant facade in Indo-Saracenic but possibly too ornate considering the purpose of the building. If so much is to be put into the facade of a building used as a printing press how shall we distinguish our temples and churches and our important public buildings? There is also

the pleasant stone facade of the motor car section of Messrs. Addisons' premises and the creditable new white plaster building which houses the Fiat cars. Khaleel Mansions, the large block of shops and flats at No. 35, Mount Road, deserves mention as about the only building that is in scale with the road and for its stone columned and arched verandahs carried the length of the facade. On the opposite side of the road is one of the finest of the old bungalows of Madras now the Government Muhammadan College. The classic facade and the fine double sweeping outside steps leading to it were inspired by the celebrated mansion at Drior Park, Bath, England. Wings have recently been added but owing to the trees and an ugly hostel in the foreground a good comprehensive view of the whole block is not easily secured from Mount Road.

Of modern domestic architecture there is very little that can be seen from the public street that can be recommended. It is generally cosmopolitan in style exhibiting most of the defects of the West and the East, the more costly buildings being the least meritorious, often exhibiting a

jumble of unreasonable, unnecessary and undesirable ornament, having no relationship to structural requirements. They lack the fine classic proportions of the old eighteenth century bungalows and the charming Indian detail, so much of which can still be seen in the back streets of Georgetown, Triplicane, etc.

A poem by Mr. James Laver which appeared in *The Spectator* of September 22, 1928, though written with respect to London, is so appropriate to Madras in general and Mount Road in particular that I make no apology for quoting the last verse—

> Ye, who rebuild our City,
> Pause, and reflect awhile,
> And, at the least, for pity,
> Evolve an urban style!
> Be taller, stronger, ruder,
> But do not merely go
> From imitation Tudor
> To pseudo-Esquimaux!

R. D.

ST. MARY'S CHURCH, FORT ST. GEORGE, MADRAS

Fort St. George dates from 1640, when Francis Day on behalf of the East India Company obtained the concession of a strip of land at Madraspatam from the Rajah of Chandragiri. The land was intended as the site of a small fortified settlement for the English trading community, which was in danger of being attacked by the rival Dutch merchants. Fort St. George was thus the earliest of the British fortified settlements in India. It was a factory, in the older meaning of that word, that is, a centre for trade. Within the Fort there were erected the buildings necessary for trading purposes and in addition houses to accommodate the Company's staff. The first Fort was completed by 1650; a second Fort was constructed in 1666, while the third and final Fort was completed in 1787 and it is this Fort which we see to-day.

In the early days of the Fort religious services were conducted in a room in the inner Fort, somewhere on the site of the present Secretariat. But on the arrival of Streynsham Master in 1677, as Agent and Governor of Fort St. George, it was decided to build a church within the Fort. A subscription list was issued and the Governor headed the list with a subscription of 100 pagodas. The Church was built entirely out of the money subscribed, and the Company provided no grant. Work was begun on Lady Day (March 25) 1678, and the Church was therefore dedicated to St. Mary the Virgin. It was consecrated two years later by Richard Portman, Chaplain, on St. Simon and St. Jude's Day (October 28) 1680. St. Mary's was the first Anglican Church to be erected in India. The architect and builder was William Dixon, Chief Gunner and Designer of Bastions to the Honourable East India Company. Ecclesiastical architecture was apparently a side-line with him, but he built the Church on sound military principles. The roof of the Church was made five feet thick, to render it proof against the heavy artillery and bombs of that day.

Since then a further three-inch roof has been added. The present Church remains much as it was designed in the seventeenth century, except for the addition of an Organ Chamber, a Priest's Vestry and a Sanctuary. The spire was rebuilt in 1795-96.

Streynsham Master was succeeded as Governor in 1681 by a more famous personage, Elihu Yale. Yale was a New England colonist by birth but had been educated in England. He entered the service of the East India Company as a writer, or clerk, and was sent to Madras where he remained many years, until he finally became Governor. His marriage was the first to be solemnized in St. Mary's; three of his children were baptized in the font. He was a generous benefactor of the Church, as his gift of the Yale alms dish bears witness. His son David Yale was buried in the old cemetery, and the monument to him is one of the two still left standing on the original site.

Yale's greater claim to fame lies outside Madras. When he returned to England he was asked by some colonist friends to assist in the founding of a place of learning in New England.

He replied to this request by sending a large gift of books, worth then over £500, and the infant university in New Haven, Connecticut, was subsequently called Yale University.

St. Mary's has not always been used for religious purposes. Twice it has been used for more urgent undertakings. It was turned into a temporary barracks in 1751, previous to the French siege, while in 1782 it was used as a storehouse for food for the French and Dutch prisoners.

The cemetery connected with the Church has had a curious history. It formerly occupied the site of the present Law College. During the siege of Madras by the French in 1758-59 the enemy took cover behind the walls and monuments of the cemetery. When the Fort was recaptured, the cemetery was given up for military reasons, and the inscribed stones were removed to form a pavement round the Church. Two monuments only were allowed to remain, and they are to be found there to-day ; they were the monument to David Yale, and the family vault of the Powneys. In 1782 the grave-stones were torn up again, to be used this time as gun-

mountings, and many were thus broken. The rest were replaced in 1807 and they now form a pavement on the north side of the Church. The inscriptions on the stones are in a variety of languages—Armenian, Latin, English, Portuguese and Tamil. The earliest stone dates from 1652, and is inscribed to the memory of Elizabeth Baker, who was the wife of the first Governor of Fort St. George ; she died on her way to join her husband at Madras. Some of the stones in the pavement were taken from the cemetery of the Capuchin Church of St. Andrew which once existed within the Fort.

The Monuments. Within St. Mary's are buried many famous Englishmen who served in India. Some of their monuments may be briefly mentioned.

Six Governors of Fort St. George lie buried just below the Chancel steps. One of them had an unpleasant fate. Lord Pigot served as Governor from 1755-63, made a fortune of forty lakhs and bought an Irish peerage. He retired, but was recalled by the Company in 1775 to serve as Governor of Fort St. George ; his special purpose was to put down corruption

among the Company's servants. On his arrival he was seized by his enemies on his Council and imprisoned at St. Thomas' Mount, for eighteen months, and he died in prison. His grave is marked by an incised cross, and the inscription, In Memoriam.

There were two Lord Hobarts who were Governors. The first was Governor from 1794-98 and his first wife and child are buried in St. Mary's ; he gave his name to the capital of Tasmania. Another Lord Hobart who was Governor from 1872-75 is buried in the Church. In memory of him his wife gave the lectern and the Princess of Tanjore presented the altar rails to the Church.

On the north side there is a fine statue by Ternouth of General Conway, who was Adjutant-General of the Madras Army, and died in 1837. He was known as 'the Soldier's Friend'. Seeing the pitiable conditions from which the British troops suffered, he secured the erection of permanent barracks for them and also an allowance of not less than a shilling a week for each serving soldier.

To the left of the Conway statue is a tablet

to the famous missionary, the Venerable Frederick Christian Swartz. Swartz was first a Danish missionary, but he afterwards entered the service of the S.P.C.K. Hyder Ali held him in high esteem, as the only trustworthy European available, and entrusted him with despatches. Swartz was allowed to pass unmolested in times of war, 'for he is a holy man and means no harm to my Government.' He died on February 13, 1798.

In the centre aisle of the Church is the tomb of Vice-Admiral Sir Samuel Hood, who commanded the East Indies Fleet; he died on Christmas Day, 1814. He came of a family of illustrious sailors, while his wife was renowned for her lion-shooting exploits in India.

Another tablet of interest is one on the south side of the Church, in memory of Sir Barry Close, who rendered distinguished service at the siege of Seringapatam in 1799, and was afterwards Resident in Mysore. Above this tablet is a fine piece of work by Flaxman, in memory of the Rev. Richard Leslie, Chaplain of St. Mary's, who died in 1804.

Over the altar is a large picture of the Last

Supper which is ascribed to the school of Raphael. It is said to have been seized by the British when they captured Pondicherry from the French in 1761.

The organ is the fifth which has been placed in the Church. The first of the series was installed in 1687, the present one in 1894. The second organ travelled a good deal. It was removed by the French from Madras to Pondicherry, then it was recovered and brought back to Madras, after which it was transferred to Calcutta.

The Church Records. The records of the Church contain many interesting documents, which may be seen on application to the Chaplain. There is a Bible dated 1660, which belonged to Streynsham Master, who was once Governor of Fort St. George, and took a leading part in the founding of St. Mary's. Another interesting document is a Prayer for the East India Company dated 1694, which was sent out by the Bishop of London for use in the Church. The Church Registers take us back to the consecration of the Church in 1680. The first register is a parchment

copy, made in 1739, of the original register. The registers give a complete record of the Church, except for the three years, 1746-49, when Madras was in the possession of the French. The first marriage entry is that of Elihu Yale to Catherine Hinmers on November 4, 1680. Another marriage entry of interest is that of Robert Clive to Margaret Maskelyne on February 18, 1753. The first baptism was performed on the opening day of the Church. Job Charnock, the founder of Calcutta, is also mentioned in the registers. He rescued by force a Hindu widow who was about to commit suttee ; by her he had three children, who were all baptized in St. Mary's.

The minutes of the Vestry meetings are of great interest. One curious extract deals with the question of small-pox in 1764 as follows :—

'Upon considering the happy success Inoculation has everywhere met with, and the many lives, under Providence, it has been the means of preserving—and the general observation that the best sort of small-pox is therefore produced, the danger next to nil and the recovery easy, it is agreed to desire the Surgeon

attend the Hospital, when the season is most proper, to inoculate such Charity children as have not yet had the small-pox.'

Another document of some importance is a copy of Clive's despatch to Lord Pigot, Governor of the Fort, with a plan of the battle of Plassey.

The Church Plate. The Church possesses some fine plate. There is the Yale alms dish, embossed with the Yale coat of arms, already referred to ; it was given to the Church in 1687. The Goldsborough plate, presented in 1689, was made to fit inside the font to form a silver lid. There is also a fine Danish plate from the Danish Mission at Tranquebar, and a Danish wine flagon and a gold-plated individual communion set. One composite chalice is of special interest : the stand is a French chased silver candlestick, the bowl is of English beaten silver work, while the lid is of Indian design and workmanship.

There are also a number of regimental colours, belonging mostly to disbanded Madras regiments, kept in the Church.

E. J. B.

GOVERNMENT MUSEUM, CONNEMARA PUBLIC LIBRARY AND ORIENTAL MANUSCRIPTS LIBRARY

In Pantheon Road, next to the Maternity Hospital, in a group of red brick buildings, are housed the Government Museum and Connemara Public Library. Both are open to the public from 7 A.M. till 5 P.M., and the latter half an hour later in the cold weather and an hour in the hot weather, except on Fridays when both are closed throughout the day and after 12 noon on the first Saturday of every month when the Museum is reserved for ladies only and the Library is closed.

The ground floor of the building nearest the road, to the front of which the Museum Theatre is attached, is devoted on one side to prehistoric antiquities, and on the other to an interesting collection of old arms, mostly from the Madras

Arsenal and Tanjore Armoury. Above are galleries containing collections illustrative of the ethnology of the Presidency, and a large collection of South Indian metalwear, the latter including articles used in household and temple worship, and an exceptionally fine set of Hindu images together with a few Buddhist ones.

The next building contains the Connemara Public Library. The Oriental Manuscripts Library is at present housed in a small building at the back of the Museum. It is ultimately to be amalgamated with the University Library, now temporarily located in the Senate House.

The third and last building contains the rest of the Museum collections. The centre and south-western wing are devoted to Zoology, the north-western wing to Geology and Botany, and the north-eastern wing to Economic Botany and Geology on the upper floor, and to Archæology on the ground floor. Special attention may be directed to the collection of South Indian birds and fishes, the former including several groups mounted with their nests in natural surroundings; the collection of timbers and building stones; the old hand painted and

printed palampores at present temporarily housed in the Economic gallery; and the fine collection of sculptures from the ancient Buddhist stupa at Amaravati on the bank of the Kistna river, depicting scenes from Indian life of about two thousand years ago.

F. H. G.

THE VICTORIA TECHNICAL INSTITUTE

THOSE wishing to see a representative collection of the metal, ivory, wood and textile art products of South India will find one in the Victoria Technical Institute, Pantheon Road, Egmore. It is open to the public daily from 8 A.M. to 6 P.M. except on Sundays and such other public holidays as are observed by the Madras Trades Association.

This Institute was founded by money publicly subscribed on the occasion of the Jubilee of Queen Victoria in 1887, and had for its object the spread of technical education throughout the Madras Presidency. On the death of the same Queen further subscriptions were raised and, with assistance from Government, a beautiful building was erected wherein to display and expose for sale examples of the ancient art industries of the Presidency, in the hope that by

providing a convenient market they might be saved from the extinction with which many of them were threatened. The Institute is governed by a council, partly elected by its members and partly nominated by Government, and is thus a public trust for assisting the craftsmen to earn a decent livelihood.

The main object of the Institute is to assist the old indigenous industries, but it has never been possible to separate these from their modern developments, and from handicrafts developed by missionary and other philanthropic institutions. As a result of the Women's Work Exhibition held in Madras in 1919 a committee of ladies was therefore formed in 1920 to assist the council of the Institute in the encouragement of women's industries, chiefly embroidery and lace. Their show-room will be found on the right of the entrance to the main hall.

As the Institute exists solely to provide the craftsmen with a reliable market, and has no dividends to pay, prices are fixed with only the small margin of profit needed to prevent it from working at a loss, and no reduction can be made on the figures marked.

The metal work, besides spoons, vases, trays and other vessels of brass, copper and silver manufactured in Madras city and other parts of the Presidency, includes animals of brass or silver (the latter suitable for menu holders) from Madura, flexible brass fishes from Ganjam, mixed metal work (copper and silver on brass) from Tanjore, ornamented brass vessels on a basis of cocoanut shell from Quilandy, various articles composed of replicas of old silver coins from the Malabar coast, and silver images of Hindu gods from Mysore.

The ivory work includes images of Hindu gods, powder boxes, paper knives, etc., from Trivandrum, and boxes of sandalwood overlaid with delicate designs in ivory from Vizagapatam. When work of good quality can be obtained ivory inlaid work from Trivandrum and Mysore is also stocked; but, though the designs are beautiful, putty is as a rule freely used, particularly in Mysore, to hide bad workmanship, and the Institute refuses to stock work of such poor quality in order to discourage it.

The wood work includes sandalwood carving from Mysore, carved furniture from Madras,

Madura, etc., toys from Channapatna, Kondapalli and Palghat and lacquer work from Kurnool. Cane furniture is also stocked.

Textiles, in addition to embroideries and other women's work from all parts of the Presidency, include cotton prints from Masulipatam and Vaniyambadi, hand painted cotton cloths from Karuppur and Kalahasti, wax dyed cotton cloths from Karuppur, muslins from Madura, and silks from Madura, Salem, Tanjore, etc., as well as scarves, saries, etc., from Madura, Salem, Kumbakonam, etc. Also mats of grass and of cocoanut fibre, druggets and carpets.

F. H. G.

MAHABALIPURAM OR SEVEN PAGODAS

At the village now generally known as Mahabalipuram or Seven Pagodas, picturesquely situated in rocky country a little more than thirty miles south of Madras, are some of the finest rock carvings and oldest and most interesting temples of south India.

The earliest South Indian Hindu temples now remaining are caves excavated in the solid rock by the Pallava King Mahendra I. Towards the middle of the seventh century he was succeeded by his son Narasimha I, also known as Mamalla or Mahamalla, and it may be to him that Mahabalipuram owes its name as well as most of its temples. There is reason to believe that it was the port for Conjeevaram the capital of these kings, and that it was the Malanga mentioned by Ptolemy. It may not improbably, also, have seen the departure

of some at least of the Hindu colonists of the Malay Archipelago. Here Mamalla developed his father's style of architecture, carving numerous temples, both in the form of caves and free standing, from its rocks. Its name, consequently, it has been suggested, may have been changed at this time to Mamallapuram or Mahamallapuram. Of this the modern Mahabalipuram is presumably a corruption with which the legend of Bali has naturally been associated. After Mamalla's death his successors of the same dynasty continued for some time to construct temples here of the same type.

The remains of the palace of these early kings can still be seen on the summit of the plateau north-west of the modern lighthouse, where there is a thick deposit of brick debris and masses of broken concrete as well as the terraced footings of foundations. The buildings were evidently made of perishable materials. Near these remains is a polished slab of rock with a lion above it that seems to have been made for a throne, and a stone cistern known as Draupadi's Bath.

Mamalla's free standing temples have a

unique interest architecturally, being the oldest such temples in South India, and the starting point, so far as we can now identify it, of the Dravidian style of temple architecture. Though free standing they are all monolithic, being carved out of solid rock. The best examples are the group known as the Five Rathas, from the local legend which regards them as the cars of Draupadi and the five Pandava Kings, though the sculptures and an inscription on one of them prove them to be in reality a group of Saivite temples.

The Parvati temple, locally known as the Draupadi Ratha, is the smallest and simplest. Apart from its ornamentation, it is evidently a copy in stone of an ordinary square hut with a thatched roof supported by curved bamboos, and its shape is identical with that of the buildings in which the city walls end beside the city gateways depicted about five hundred years earlier in the sculptures from the Buddhist stupa at Amaravati, now in the Madras Museum.

The designs of the other four temples appear to be based on those of Buddhist monasteries and assembly halls. Buddhist monasteries com-

monly consisted of a central court surrounded by the monks' cells. Some, however, are known to have been several storeys high and to have been supported on pillars arranged like those of an ordinary Hindu mandapam ; and the ground floor sometimes covered so large an area that it is scarcely possible that the upper storeys could have been of equal extent. Probably successive storeys were smaller and smaller, giving the building a pyramidal form. That the pyramidal temples of the Pallava period were suggested by such monasteries seems to afford the most probable explanation of their origin. In these temples the parapet walls surrounding each of the upper pillared halls are decorated with a number of miniature pavilions, probably representing the monks' cells, often with carved human faces looking out of their horseshoe-shaped windows, while the halls themselves become a series of niches in which figures of deities are represented. The so-called Dharmaraja and Arjuna Rathas are of this type, and to them the more modern forms of shrine, or vimana, in a Dravidian temple can be traced back.

Buddhist assembly halls ordinarily contained a stupa, or sometimes a figure of Buddha, at the end opposite to the entrance, and the wall was carried round this in a semicircle. This form was adopted for the temple now commonly known as the Ratha of the twins Nakula and Sahadeva, though the ornamentation is uniform with that of the pyramidal temples, recalling a monastery of several diminishing storeys. The remaining temple of the group, which is known as the Bhima Ratha, is of the same general type as the Ratha of the Twins but has both ends straight. A structure similarly decorated might well be built over a gateway as an ornamental modification of the fortifications illustrated in the carvings from the Amaravati stupa already referred to ; and this is evidently the origin of the enormous gopurams which form such a conspicuous feature of more recent temples of the Dravidian style.

As a fine example of a somewhat later monolithic temple, carved by Parameswaran I, Mamalla's second son, attention may be directed to the Ganesa Ratha, which will be found to the north-west of Arjuna's Penance (see below).

The rock carvings are mostly in the cave temples. Statues which may represent contemporary Pallava kings can be seen (by Hindus only) to the south-west of the lighthouse in the Varaha Cave, over which a small temple has been constructed. But the best known carvings are the sleeping Vishnu, and Kali slaying a demon, which will be found a little to the south of the lighthouse in the rock surmounted by the conspicuous little Olakkanneswara Temple; Krishna sheltering cowherds from rain sent by Indra, in the cave temple facing the village; 'Arjuna's Penance' in the open beside it, and the boar and dwarf incarnations of Vishnu and the Trimurthi in temples in the rocks behind these. Further north will be found the remarkably balanced natural rock known as Krishna's Butter Ball.

The largest of the rock carvings is also the most puzzling. It is locally known as Arjuna's Penance; but several authors have pointed out that all the figures face the deep cleft that extends down the rock at some distance from the figure of the ascetic, who thus does not form the centre of the picture. This has led to the

suggestion that the ascetic is not Arjuna but Bhagiratha, and that the cleft represents the Ganges descending from heaven. Unfortunately for this theory, Siva is standing on the side of the ascetic farthest from the cleft, where he could not possibly entangle the water in his hair. From his posture he might well be granting the ascetic the boon for which he had been praying and this would fit well with the story of the way in which Arjuna received from Siva the arms he required for the great battle. Professor Krishnaswami Aiyangar has suggested that three scenes are combined in the picture to the left of the cleft. Below is Arjuna as an ascetic beside a small shrine of his traditional God Vishnu. Above are Siva's boar hunt to the left and Siva offering his boon to Arjuna to the right. The whole of the right half of the picture can then be taken to represent animals and celestial beings watching the scenes depicted on the left.

The Shore Temple and the Olakkanneswara Temple, like the Pallava temples of Conjeevaram, differ from the temples of Mamalla and his immediate successors in being built of cut

blocks of stone instead of being carved out of the solid rock. They date from towards the end of the Pallava period and were probably erected by Rajasimha, (=Narasimha II, son of Paramaswaran I), who came to the throne towards the end of the seventh century.

The cave temples of Saluvankuppam, situated in a clearing among casuarina trees about two miles north along the coast from the Shore Temple, are well worth a visit by any one who has time to get there, the more striking of the two being decorated with horned lion heads, from which it has come to be known as the Tiger Cave. Both inscriptions, and the decoration of pilasters with rearing lions, show these temples to be of about the same date as the Shore Temple.

F. H. G.

THE TEMPLES OF CONJEEVARAM

CONJEEVARAM or, more properly, Kanchipuram, can be traced back to about the third century A.D., when it was already the capital of a king belonging to the Pallava dynasty. It is probably the only place in which the development of the Dravidian style of temple architecture can be traced from Pallava times onwards in a single town.

An inscription by the Pallava King Mahendra I, who came to the throne about A.D. 600, shows that before the days of his rock-cut temples it was customary to build temples of 'bricks, wood, metals and mortar'; and stone pillars from a temple which he constructed, presumably in this manner, have been built into the Paurnami Mandapam of the Ekambaranatha Temple. These are possibly

the oldest Hindu architectural remains in South India, antedating as they do his son Mamalla's temples at Seven Pagodas and perhaps his own cave temples also. The oldest temples still standing at Conjeevaram in their original form date, however, only from the later part of the Pallava period, and are contemporary with the Shore Temple at Seven Pagodas.

The largest of them is the Kailasanatha temple, built by Narasimha II, also known as Rajasimha, who came to the throne about A.D. 690. The entrance is through a gateway surmounted by a small gopuram. This gateway leads into a court which, though of approximately the same date as the main building, was evidently not part of the original design; and the position of the original entrance is occupied by a shrine still surmounted by a larger gopuram than the outer one instead of by a conical vimana tower. But the vimana tower over the central shrine rises to a much greater height than either of the gopurams. The corbels are rounded as in all Pallava temples. Squatting lions are used as supports for the pillars and rearing lions to decorate the pilasters, as in the

Shore Temple at Seven Pagodas, which was probably built by the same king.

Four smaller Pallava temples are situated not very far from the railway station. The most important of these is the Vaikunta Perumal Temple, which was probably built either by Rajasimha's son Parameswaran II or by the latter's successor Nandivarman Pallavamalla. It is chiefly famous for the scenes from contemporary history carved on its walls. Unfortunately none but Hindus are admitted to see them.

A mile or two beyond the Kailasanatha temple, across the Vegavati river, lies the village of Tiruparutikunram. Its temple, which belongs to the Jains, is of exceptional interest as it is not, like most other South Indian temples, all in one style of architecture, but in three distinct styles representing respectively the Pallava, Chola and Vijayanagar periods, (roughly A.D. 600-850, 850-1350 and 1350-1600). A small building in the garden adjoining the main temple is clearly Pallava work, with rounded corbels and rearing lions of the type found in the Kailasanatha temple. The main

temple dates, as is shown both by inscriptions and by architectural style, from early in the Chola period and to it a mandapam has been added in the Vijayanagar period, the ceiling of which is decorated with paintings illustrating the lives of some of the Jain saints. In the Chola temple the simple rounded pillars are surmounted by square corbels from which a triangular piece has been cut away on either side, a type still in common use at the present day but unknown before Chola times. In the Vijayanagar mandapam fluted pillars bear cobra-hood ornaments at their base and are surmounted by corbels carved as lotuses. These are features still in common use, but first introduced in the latter part of the Chola period. The lotuses on the corbels, though often indicated in the later Chola period, were not properly developed before the Vijayanagar period. In more recent buildings they tend to become more and more elongated until finally they are transformed into plantain flowers.

The three largest and most sacred temples of Conjeevaram, and most of its innumerable

minor ones, date from the Vijayanagar period (about A.D. 1350-1600). Only the three largest can be referred to here.

The towers of the Ekambaranatha temple are conspicuous on one's right as one enters the town by the direct road from Madras (*via* Sriperumbudur, the birth-place of Ramanuja). These towers are all gopurams built over gateways, the vimana towers over the shrines being of insignificant size. They are of stone below with brick and plaster above, stone rarely if ever being used for the upper storeys of such towers. In the Pallava period the vimana tower always dominated the gopurams as has already been noted in the case of the Kailasanatha temple. In the early Chola period this continued to be the case and vimana towers of enormous size were erected, of which that of the Tanjore temple is the finest example. In later Chola times, however, the fashion changed and the gopurams became the dominating feature, the vimanas being allowed to remain of quite small size, a fashion which has continued to the present day. Since however, the finest Chola gopurams were already so large that it was almost impos-

sible for later builders to erect finer ones, the builders of the Vijayanagar period, turned their special attention to elaborate carving, for the display of which the mandapams or pillared halls gave greater scope than the gopurams; and the wonderful workmanship of these halls is usually the most striking feature of their temples.

The greater part of the Ekambaranatha temple is in a somewhat dilapidated condition but the colossal carved stone pillars on either side of the main gateway are very fine. A good general view of the temple can be obtained from the top of the gopuram over this gateway. The main shrine of the temple contains the Earth Lingam. Though sacred to Siva, no temple to his consort Parvati is found within its precincts. Instead she is worshipped under the local name Kamakshi in an entirely separate temple not very far away. This temple is built in the same style as the Ekambaranatha, though its gopurams are not nearly so big. The mandapam bears some beautiful carving especially round the plinth, but is in a dilapidated condition.

The Varadaraja temple of Little Conjeevaram, which also dates from the Vijayanagar period, is the most magnificent of all the Conjeevaram temples. The main entrance is through an immense gopuram. On the opposite side of the temple, so far away as to be obscured from view by other buildings, is a still finer one ; but this, being under a curse, cannot be used for entering the temple on ceremonial occasions. Between these two gopurams is a walled enclosure containing the central shrine and between the entrance and this enclosure are two graceful little shelters each supported by four tall slender pillars. To the left of these is the principal mandapam and beside this a fine tank with a couple of small mandapams in the middle. The principal mandapam is most wonderfully carved. At each corner there is a stone chain, carved from a single block. At the corner nearest the temple entrance there is a remarkably realistic group of pigeons and cats at the edge of the roof. And the monolithic pillars by which the roof is supported are all of them richly decorated with mythological and other figures, while the lotus corbels above them are

well carved examples typical of the Vijaya-nagar period. This temple is also famous for its jewels, some of which were presented by well-known men such as Clive and Tippu Sultan.

F. H. G.

INDIAN INSTITUTE OF SCIENCE, BANGALORE

Among the many patriotic benefactions of the late Mr. J. N. Tata, none has evoked more interest and admiration from scientific men than the foundation of the Indian Institute of Science, Bangalore. Although most unhappily he died before the conception took physical shape, the loyalty and generosity of his two sons, Sir Dorabji and (the late) Sir R. J. Tata made it possible to admit the first students on July 24, 1911, by which date the departments of general chemistry, applied chemistry and electrical technology had been constructed and equipped. Ten years later, the functions of the applied chemistry department having been assimilated to those of general and organic chemistry, a new department of bio-chemistry was inaugurated, in recognition of the numerous economic problems peculiar to India which group themselves naturally in this branch of knowledge.

The Indian Institute of Science is a post-graduate institution having for its object the promotion of advanced study and original research with special regard to the educational and economic requirements of India. At the time of its foundation, the opportunities offered to post-graduate students for instruction in methods of research at Indian universities with a few exceptions were slender ; and although the proceedings of the Indian Science Congress provide increasing testimony to the great improvements in this respect effected in the past fifteen years, it is gratifying to record that the result has been to widen and stimulate the desire to enter the Institute, close upon five hundred applications having been received in the three years 1925-28. Thus the need for such an institution as estimated by the Tata family has been amply demonstrated.

The system of training in the three departments of chemistry consists in a preliminary course of lectures and experiments designed to bridge the gap between completion of studies for the degree and embarkation on research : as soon as possible thereafter the student is intro-

duced to some chemical problem, and after devoting himself to this for a stated period may be awarded the Associateship. The laboratories have the ordinary equipment of steam, gas, high-pressure water, vacuum, current (direct and alternating), besides including a comprehensive collection of apparatus for physico-chemical work and precise measurements. A liquid-air machine and a hydrogenation plant, with various types of stills, furnaces, extractors, autoclaves, grinders and crushers facilitate investigation of natural products and research on a semi-industrial scale. In the biochemistry department sterilisers, centrifuges and fermentation plant have been added to the foregoing ; a laboratory devoted solely to microanalysis, and a cold chamber, are also available. Weekly meetings of students and staff are held for discussing subjects of current chemical interest, or the reading of papers describing inquiries conducted at the Institute. During the long vacation, facilities are offered to members of teaching staffs in other Indian scientific institutions who may wish to pursue their researches while on leave.

In the department of electrical technology the plan of instruction has been modified to supplement the training of applicants who aspire to responsible positions as electrical engineers, and for those who are well-grounded in mechanical engineering and higher mathematics follows a regular two years' course, at the close of which a certificate is awarded. When accommodation is available, graduates in physics and mathematics may be admitted, but are required to undergo a special preliminary course of one year at an engineering college. Arrangements are made for the long vacation to be spent in some engineering works, generating station, or power-house; to give wider practical experience and to study the ordinary routine of a commercial enterprise. The purpose of the chemistry colloquia is fulfilled in this department by the Electrical Engineering Society, which holds meetings at regular intervals, and publishes a journal entitled 'Electrotechnics'. A valuable and up-to-date collection of electrical machinery, plant and apparatus has been assembled, and ample opportunities provided for studying (1) the properties of direct and alternating current

circuits, (2) the generation, transmission and distribution of electrical energy for power, light and traction, (3) machinery and equipment for traction, (4) the theory and design of electric machinery, and (5) problems of insulation and high tension insulators. Lectures and classes in some subjects of mechanical engineering, a drawing-office for the design of machinery and the lay-out of electrical schemes, and a work-shop for the construction of apparatus required in research and the maintenance of existing appliances, are also provided. A notable recent addition to this department is a section for the study of electrical communication engineering, embracing telegraphy and telephony, modern high-speed automatic signalling and recording by wireless and line radio systems, direction and position-finding.

The library is a specialized one, consisting principally of the journals of different nationalities describing the details of current researches in chemistry and engineering, and numbering over 150. These, with some advanced text-books, comprise over 14,000 volumes and there is also a complete collection of Indian Patent

Office specifications. To meet the requirements of students unfamiliar with French and German, classes in these languages are given by the librarian. The amenities of the hostel have been materially extended by the Students' Gymkhana Club, the gift of Sir Dorabji Tata, and athletic needs are met by a gymnasium, four tennis-courts and a cricket, football and hockey-ground.

In selecting a site for the Institute it had to be recognized that in India, owing to the great distances which separate the large cities and centres of industry, it is not practicable to secure that frequent personal association between workers in the several fields of intellectual activity enjoyed in European countries and the United States. Consequently, more weight was given to climatic conditions than to the possibility of approximating to some industrial area. The location finally chosen is 3,000 feet above sea-level and is probably the most favourable that could have been found in this country, it being possible to work in Bangalore during the greater part of the year without undue discomfort. The Government of H.H.

the Maharaja of Mysore generously allocated an area of 370 acres about four miles from the City, and on about one-half of this have been accommodated the laboratories, the hostel and bungalows for the teaching staff, disposed along the sides of a rectangular maidan dominated from one end by a handsome granite building containing the library, offices and council chamber, and crowned by an imposing tower, one hundred and sixty feet in height. Fifty yards from the main entrance there stands a beautiful monument, the main feature of which is a striking bronze statue of the founder, the late Mr. J. N. Tata. This was unveiled by H.H. the Maharaja of Mysore in 1922.

This description of the Indian Institute of Science has hitherto been strictly quantitative : but in dealing with the considerable volume of results already achieved it is not practicable to follow this method. In one sense, the task of building character, of inculcating clearness of thought, habits of industry, perseverance in the face of disappointment and precision of craftsmanship, is the most important one assumed by the Institute, which has now distributed

throughout the country a substantial body of men trained in the art of making and appreciating knowledge and in the technique of solving a problem. It is not possible to attach a definite estimate of value to this particular achievement, however, and it is therefore desirable to indicate some of the more material benefits to Indian economy which may be claimed as a direct outcome of the founder's munificence.

Although commonplace from a scientific standpoint, the most remunerative industrial item has been to translate the manufacture of sandalwood-oil from Germany to India. This essential oil, obtained by distilling the finely divided wood in a current of steam, is highly valued medicinally and in perfumery. Arising directly from experiments conducted at the Institute, two sandalwood-oil factories have been successfully established by the Government of Mysore ; the profits from these alone would have amply covered the whole cost of the Institute, and indirectly the general methods of distilling essential oils throughout the Indian peninsula have improved. Another profitable outcome

of experiments in the departments of general and organic chemistry has been to elaborate a process for the manufacture of white-lead, required in large quantities for producing paint : this has now been extended to the commercial scale in Bangalore, where a factory has been established to produce a substantial annual tonnage. Similarly practical inquiries into the use of local oils for soap manufacture have led to the foundation of a factory in Bangalore where high-class soaps are made under the auspices of the Government of Mysore, and experiments on the composition of lead-pencils have resulted in the manufacture of these articles in Madras.

Experiments on the by-products obtainable from different varieties of woods when distilled have been useful to the Bhadravati iron works, and the tanning industry has been assisted by a process for converting Indian chromite into sodium dichromate. Considerable improvements have been effected in the products from solar evaporation of sea-water and pit-brine, in the refining of saltpetre and in the recovery of caffeine from tea-waste. Work with fixed oils

has comprised experiments on refining and hardening, the production of ghee substitutes, determination of the constitution of some less-known oils, and an examination of the relation between iodine values and refractive indices of hardened oils. Many of these inquiries await more favourable economic circumstances for commercial development, and conversely others have served the financially valuable, although negative, purpose of preventing fruitless outlay of substantial capital on enterprises predestined to failure.

In a manner resembling that outlined in the foregoing paragraphs, the departments of applied chemistry and subsequently that of bio-chemistry may be correlated with definite economic advantages to India. From preliminary fermentation experiments conducted at the Institute the plans for the acetone factory at Nasik were elaborated, and former students remain in charge of the operations by which alcohol is now produced instead of acetone. The system of sewage treatment and water-supply prevailing at Jamshedpur is based on advice proceeding from the Institute, and a

well-equipped laboratory for the necessary bacteriological and chemical work is conducted by former students. For many years past, the principles underlying bacterial and chemical changes involved in the activated sludge process have been closely studied, and a considerable variety of changes depending on fermentation examined with a view to utilizing waste-carbohydrate resources for producing power alcohol. Much attention has been given to the cultivation of lac, the habits and requirements of the lac insect, the recognition of its parasites and the preparation of the resin for market purposes : a considerable area of trees appropriate to the propagation of lac insects has been made available to the Institute by the Government of Mysore.

The department of bio-chemistry is also making a concerted attack on the problem of spike disease in sandal, and for this purpose a special grant has been made to the Institute by the Government of Madras and the Chief Commissioner for Coorg. The general principle underlying this campaign is to make a rigid analytical comparison between the healthy and

spiked tissue in respect of chemical composition, diastatic activity, chemical and physical properties of the sap, and the prevailing soil conditions : transmission of the disease through grafting and budding concurrently with the influence of different host-plants on the growth of healthy sandal are being studied in field and laboratory. Other matters having an economic bearing and now engaging the attention of this department are (1) a systematic survey of the vegetable proteins of Indian foodstuffs, (2) the isolation and study of enzymes, and (3) problems connected with fixation of nitrogen in soils. The papers describing the foregoing investigations, together with those proceeding from the department of electrical technology are published in the Journal of the Institute, of which approximately 170 parts have now been issued. These include also many contributions of purely academic interest which have served the purpose of introducing their authors to methods of research in the respective branches.

In concluding this review of the contribution to the educational system of India and to the development of her potential industries made

by the Institute, it is proper to mention the names of those who have been more conspicuously responsible for moulding its technical activities. Dr. M. W. Travers, the first appointed director, conceived the generous lines on which the Institute is planned and inaugurated the work of the chemistry departments, while the foundation of a notably sound and thorough system of training in the subject of organic chemistry is due to Dr. J. J. Sudborough, who served the Institute during fifteen years and retiring in 1925 was succeeded for two years by Dr. J. L. Simonsen. In 1916 Dr. H. E. Watson, having rendered able service as assistant professor of general and inorganic chemistry was appointed to the professorship which he still holds ; during his tenure the department has undergone consistent development. Dr. Alfred Hay became the first professor of electrical technology in 1908, and founded the admirable system of training in that subject to which allusion has been made. He was succeeded by Professor J. K. Catterson-Smith who has very substantially increased the equipment, and has widened the scope of the

department by organizing the new section of electrical communication engineering. On the retirement of the late Professor Rudolf from the department of applied chemistry, Dr. G. J. Fowler assumed the duties and in 1921 became professor of bio-chemistry, successfully developing this branch until 1924, when he was succeeded by Dr. R. V. Norris, who has made valuable additions to the opportunities and activities of the department. The work of these officers has been facilitated and very materially assisted by the loyal co-operation of their younger colleagues, of whom the great majority have been Indian, and of whom it is gratifying to note that some are former students who have returned to the Institute after gaining widened experience elsewhere. Thus it is reasonable to hope that, the initial obstacles always confronting a new foundation having been surmounted, the Indian Institute of Science is destined to fulfil the noble aspiration of its founder as an All-India scientific research centre.

M. O. F.

THE VEGETATION OF MADRAS

To any one coming in to Madras from Northern India through Bombay, probably the most striking feature of the country is its greenness. From the black cotton soil thinly sprinkled with Neem or Margosa (*Melia azadirachta*) and Babul (*Acacia arabica*) which covers the Deccan plateau, he drops suddenly to the richer red soil of the Coromandel plains, where cocoanut plantations, rows of palmyra palms and luscious paddy fields give to the whole country a refreshing green colour.

From Calcutta the traveller by the Mail train enters the Madras Presidency at the Chilka Lake and, running never far from the Eastern Ghats, passes in turn through rich paddy fields, barren stretches of wild date palm, tobacco fields and tall sugarcane; skirts in the early morning hours the backwater of Pulicat where the Dutch made their headquarters and crosses

the Ennur estuary the creaks of which are lined with the mangrove (*Avicennia officinalis*) whose upright breathing roots can be seen rising thickly from the mud. As he approaches Madras, scattered plantations of grey-green feathery casuarina (*Casuarina equisetifolia*), force themselves on his attention. This cultivation dates from the early sixties, when under Cleghorn's advice plantations were started for fire-wood, and they have been the means of saving the indigenous trees and shrubs. They owe their success on these barren sandy shores to root-nodules akin to those of the *Leguminosae*.

Near Madras and especially to the south, there are low rocky hills covered with a thorny evergreen scrub vegetation which is peculiar to the Coromandel coastal area. The nature of this vegetation is perhaps due to the distribution of the rainfall. In contrast with the rest of India, the Madras coastal plain receives most of its rain in November, when up north the dry weather has already set in. But important showers also fall during the South-West monsoon and in April, and the more even distri-

bution of rain which these give, together with the humid sea breeze, accounts for the jungle being ever-green, though the total rainfall of under 50 inches does not allow of it being luxuriant. Chief among the woody elements of this flora are *Zizyphus xylocarpa*, *Zizyphus oenoplea*, *Carissa carandas*, *Maba buxifolia*, *Gymnosporia emarginata*, (with red arillate seeds), *Capparis zeylanica*, *Capparis horrida*, *Mimosa hamata*, *Pterolobium indicum*, *Hugonia mystax*, *Ventilago maderaspatana* and *Randia dumetorum* (with fruits like the guava). Among the fleshy plants are *Euphorbia antiquorrum* (with three angled twisted stem), *Sarcostemma brevistigma* (Asclepiadaceae) which has no leaves, *Vitis quadrangularis*, and *Caralluma atenuata*,—while the introduced *Opumtia* is rampant everywhere. In the scrub near Tirukalukkundram and on the road to Seven Pagodas are found the dwarf, nearly stemless, spiny, Date Palm, *Phoenix farinifera*, with *Cycas circinalis*.

In the tanks and paddy fields the Babul (*Acacia arabica*), thrives and one may come across thickets of this tree and of the local date

palm (*Phoenix sylvestris*) whose fruit is palatable only to small boys. This latter fruit is well developed in the compound of Government House at Madras.

After the North-East monsoon, all the pools and tanks fill up and the usual aquatic vegetation is seen. Among the interesting plants must be mentioned *Isoetes coromandelina* which grows in the bigger tanks near the bank with its stem imbedded in the mud and the leaves sticking out of the water—(the plant may easily be mistaken for a sedge *Limnophila gratioloides*) with highly dissected leaves below the water and entire leaves above, in the smaller pools *Neptunia Oleracea* with floats of spongy tissue round the stem and sensitive leaves, and *Jussiana repens* (its spongy roots aid in floating and aeration). The introduced Water Hyacinth, *Eichhornia speciosa* with swollen petioles and beautiful flowers is seen sometimes.

The strand flora merits attention, and, though in the limits of the city it is naturally suppressed (by the feet of bathers and others enjoying the sea breeze), there is something of interest even here, and a few miles north and south the

vegetation shows normal development. Along the Marina, *Ipomaea biloba, Cyperus arenarius, Pupalia orbiculata, Launaea pinnatifida* (Compositae), *Hydrophyllax maratima* and occasionally *Canavalia lineata,* make low hillocks where they bind the sand : but, at San Thome and better still at Elliot's Beach, south of the Adyar river (about six miles from the Fort), there are regular dunes covered with them and with *Spinifex squarrhosus.* On the flat sand behind these dunes at Elliot's Beach are numerous plants characterized by a very low spreading habit, *Sesamum prostratum* (Labiatae), *Perotis Geniosporum prostratum,* (Labiatae), *Perotis latifolia* (Gramineae) with stems flat on the sand, *Leucas diffusa, Indigofera aspalathoides* and *Euphorbia rosea.* Among the erect plants are *Aristida adscenscionis, Polycarpea corymbos* (Caryophyllaceae) and *Stenophyllus barbata* (Cyperaceae), while the introduced *Vinca rosea* often monopolises large stretches of ground.

Estuarine plants are to be found on the banks of the Cooum and the Adyar. Of minor halophytes we have *Suaeda nudiflora* and *Suaeda monoica, Sesuvium portulacastrum,* and

Heliotropium curassavicum (a native of South America). Mangroves are represented by *Avicennia officinalis* which has vertical pneumatophores but not viviparous fruits. Among shrubs common on the bank are *Exacaecaria aghallocha* (Euphorbiaceae), while behind these the common trees are *Cerbera odollam, Pongamia glabra, Erythrina indica* and *Thespesia populnea*—all having floating seeds or fruits.

In the estuarine region of the Adyar and in the backwaters near it is seen *Halophila oyata* and in the salt marshes behind Seven Pagodas is found *Ruppia maratima*.

A word might be said of the Madras compounds the lawn of which is largely made up of small herbaceous plants like *Justicia procumbens, Ruellia Prostrata, Tridax procumbens* (South American), *Inoidium suffruticosum, Evovulus alsinoides* and *Tephrosia purpurea*. Under shade of trees the West Indian *Ruellia tuberosa* flourishes and makes a beautiful show of pale purple flowers after the July rains.

In open spaces where they are not suppressed are *Tephrosia purpurea, Sida cordifolia, Cleome*

viscosa, Tridax procumbens, Indigofera enneaphylla, and *Tribulus terrestris.* An introduced herb which is spreading rapidly during the last few years all along the Madras roadsides and open fields is *Gomphrena decumbens* of Central America.

The Agri-Horticultural Gardens are worth a visit. The Society was founded in 1832, but the present gardens owe their general design to the late Sir Charles Lawson who laid them out in 1889. Robert Wight was one of the early members and Cleghorn, the forester who was chiefly instrumental in starting the plantations of *Casuarina* which supply all the firewood of Madras.

There is a good collection of palms of which we might mention the Royal Wine Palm of the West Indies (*Oreodoxa regia*) which is planted also a good deal in Madras, the Egyptian Doom, the Double Cocoanut, *Lodoicea sechellarum* (of the Seychelles Islands) whose growing point after ten years is still underground, and the stemless *Nipa fruiticans.* A number of ornamental palms can be seen in the Nursery. In one of the ponds a fine growth of *Victoria regia*

is worth noting. Another interesting plant is the Cannon Ball Tree of Tropical America (*Couroupita guianensis*) with its peculiar hooded flowers and huge fruits like cannon balls. On two mounds are collections of cactoid and other xerophytic plants, among the most interesting of which is *Stapelia grandiflora* whose broad flowers, half a foot across, have a small brown evil-smelling centre ('to attract flies') and concentric lines like a spider's web (as additional attraction? ! ! !) The Fern House has recently lost a number of species. But among the interesting ferns may be mentioned the fine plants of *Asplenium nidus* (Birds' Nest Fern) and the Climbing Fern, *Staenochlaena palustre*.

P. F. F.
M. O. P.

THE GEOLOGICAL STRUCTURE OF THE MADRAS PRESIDENCY WITH A SHORT NOTE ON PLACES OF GEOLOGICAL INTEREST AROUND MADRAS

A GLANCE at the geological map of South India, south of latitude 16°, shows that nearly eighty per cent. of the whole country is occupied by Archaean rocks. The rest of the area is made up of unfossiliferous sedimentary Cuddapah and Kurnool formations, taking the form of a crescent and resting unconformably on the eroded upturned edges of the ancient crystallines ; Lower Gondwana rocks (of Barakar age) in the Godavary basin ; groups of Upper Gondwana patches generally intercalated with marine Cretaceous rocks, along the east coast ; and an isolated outlier of basaltic lava-flow of Deccan Trap age. Fringing most of the afore-

GEOLOGICAL MAP OF THE MADRAS PRESIDENCY (& INSET MAP OF MADRAS)

Scale 1 inch = 160 Miles.

1. Recent
2. Low-level Laterite & Cuddalore Sandstones.
3. Deccan trap
4. Cretaceous
5. Upper Gondwanas
6. Lower Gondwanas
7. Kurnool & upper Kadapas
8. Lower Kadapas
9. Dharwars
10. Granites, Schists & Gniesses

said formations, is a coastal belt of younger Tertiary and recent formations.

The subjoined table gives a summary of the important geological formations of the presidency, and the mineral deposits associated with them.

The advancement of our knowledge regarding the inter-relationship of the various members of the Archaean group we owe mainly to the labours of Mr. R. B. Foote, who recognized and mapped over large areas of the Dharwar formations; Sir Thomas H. Holland, who discovered the Charnockite family of genetically related pre-cambrian plutonic intrusive rocks, which have a wide distribution in this province, the Elaeolite syenite series occurring at Sivamalai in the Coimbatore District, and gave an exhaustive account of the natural history and economic importance of the Peninsular pegmatites; Mr. C. S. Middlemiss, who described clearly the *ultra basic* intrusions of the Salem District, and the corundum occurrences of the Coimbatore and Salem Districts; Dr. Walker, who mapped the Kondalite series (graphite-garnet-quartz-sillimanite-schists) of Kalahandi

State, which are now known to extend from Bezwada right up to Ganjam, within limits of this province; and Dr. L. L. Fermor, who discovered the manganese-bearing Kodwite series of Vizagapatam, and made the very suggestive distinction between the Chota-Nagpur and Eastern ghat facies of Archaeans.

Archaean Rocks

The Peninsular gneisses which cover the major portion of the country are biotite gneissose granites giving rise to low rounded hillocks, and forming table-lands, in Coimbatore, Wynaad, Bellary, Arcot and Vizagapatam Districts.

The Dharwars have an extensive development in Mysore, and their outcrops are also found in Bellary, Anantapur, Cuddapah, and the extreme northern portion of Salem and parts of Wynaad, Coimbatore and North Arcot Districts. They are preserved in the form of a series of long, narrow, fairly parallel bands, extending from near Belgaum in the southern portion of the Bombay presidency, and from the Kistna river in the Nizam's Dominions,

southward through the Mysore State up to the northern portions of the districts bordering the southern boundary of Mysore. The rocks of the system include Hornblendic and Chloritic schists, Haematitic quartzites, phyllites, and sometimes metamorphosed conglomerates. There is still no general unanimity of opinion regarding the age and lithology of some of the constituent members of the system exposed in Mysore. This system forms the treasure house of most of the minerals of economic value to be found in India. Most of the principal ore-deposits of the country, the metals—gold, manganese, iron, copper, lead and antimony ; the non-metallic minerals—mica and corundum ; rare minerals—samarskite, columbite and monazite, precious stones—ruby, spinel, chrysoberyl, zircon, garnet, and amethyst ; and building and structural materials—granites, marbles, ornamental building stones, and roofing slates are found in the Dharwar rocks.

Charnockites constitute the important hill masses of the presidency, including the Nilgiris, Shevaroys, and Palnis, and also occur as bands in Coimbatore, Salem, Wynaad, South Arcot,

Vizagapatam and Ganjam Districts. They carry as accessory minerals graphite, ilmenite, and monazite and furnish an inexhaustible supply of building stones and road-metal.

In the Eastern ghat region and the neighbouring coastal districts khondalites and garnet gneisses take the place of the Dharwar schists, and the normal Peninsular gneiss, while the rocks of the Charnockite series are also generally garnetiferous in this area. Garnet, and graphite are frequently found associated with these rocks in paying quantities.

Eparchaean Interval

A vast interval of time appears to have ensued, after the formation of the Archaeans just described, during which period, they suffered much compression and metamorphism, and were upheaved, to be eroded by atmospheric agencies, into great table-lands, before being depressed below the ocean, to receive as sediments, the succeeding Pwjana group of rocks.

About the end of this Eparchaean interval,

or during the early parts of the Cuddapah epoch, the Pegmatite dykes of Nellore and Coimbatore carrying marketable mica, and rare and gem-minerals like columbite, samarskite, and aqua-marine.; the dyke rocks of North Arcot and Salem, the latter carrying chromite and magne-site, were (according to Mr. C. S. Middlemiss) intruded into the Archaeans.

The Purana Group

The Cuddapah and Kurnool series were mainly mapped by Mr. W. King, and form a great isolated crescent shaped basin, 200 miles long by 100 miles wide in their widest part. They are made up of shales, slates, quartzites, and limestones. The Kurnool series (regarded as of later Vindyan age), rest over the Cuddapahs and they contain at the base, a group of coarse felspathic and ferruginous sandstones (Banganapalle beds) some bands of which are diamondiferous. Volcanic action was common during lower Cuddapah times, as is clear by the abundance of lava flows, and tuff-beds in the type area. These rocks locally carry manganese

ores, and argentiferous galena occurs as nests, stringers, and irregular veins, metasomatically replacing the limestone members of the series.

Lower Gondwanas

The succeeding system, the first in the presidency that is fossiliferous, the Lower Gondwana formation is a characteristically freshwater deposit and is exposed on the left bank of the Godavary valley, thirty to forty miles W.N.W. of Rajahmundry. It includes, near Bedadanol, five square miles of coarse felspathic sandstones, with carbonaceous shale seams. Attempts, hitherto made by the local Government, to locate workable seams of coal in this region by boring have proved futile.

Upper Gondwanas

A few isolated outcrops of upper Gondwanas occur in a narrow strip of country between the gneisses and the east coast. In these outliers are seen both plant fossils and estuarine

molluscs, the various patches roughly corresponding in age to the Rajmahal and Umia beds. They are principally found near Rajahmundry, Ongole, Madras and Ukatur (Trichinopoly District).

Cretaceous Beds

In Trichinopoly District, the upper Gondwana rocks are overlain on the eastern side by the marine cretaceous beds, which are richly fossiliferous, most of the organisms being cephalopods and gasteropods.

Deccan Trap

An isolated outlier of volcanic rock of Deccan Trap age occurs on both banks of the Godavary river, resting partly on metamorphices and partly on upper Gondwanas ; attaining the thickness of nearly 200 feet. Near Pangudi village, seven miles from Kovvur station (M. and S. M. Ry.) the basaltic trap rock is clearly seen resting on the top of an impure silicified bed of limestone, containing estuarine molluscs.

Cuddalore Sandstone

The name Cuddalore sandstone is given to the formation stretching interruptedly from Rajahmundry to Tinnevelly, consisting of grits and sandstones, dipping gently towards the sea, and containing locally silicified wood in large quantities. The Warkalli beds found on the west coast near Quilon—of variously coloured clays, shales, grits, and sandstones, intercalated with paying seams, and layers of lignite capped by laterite—occupy the same position as the Cuddalore sandstones on the east coast as regards age, which is probably later Tertiary.

Laterite

High-level laterite is confined to hilly and elevated tracts of the country in the neighbourhood of Bellary, Cuddapah and Vizagapatam Agency and in the Nilgiri and Palni hills and is of good thickness. The low-level variety is of small and inconstant thickness, mostly detrital in character and is found all along the coast, and is extensively quarried as a building stone.

Cave Deposits

The Billasurgum cave deposits in Kurnool district are encrusted with stalagmite, and contain red marl full of mammalian remains, some of them representing extinct species.

Recent Deposits

The recent deposits include the *Teris* of Tinnevelly and Travancore coasts, the older alluvium of the larger rivers as the Godavary, Kistna, and Cauvery, the coast and deltaic alluvium, the younger alluvium of the present river-beds, the mud-banks of the west coast and the peat-deposits on plateau regions as the Palnis and Nilgiris. The coastal alluvium near Pondicherry has furnished a good artesian water-supply.

Local Alterations of Level

Illustrations of minor, more or less local alterations in level, both of elevation and depression within sub-recent and pre-historic

times are given below. In Tinnevelly district evidence of recent subsidence is furnished by a submerged forest, and the presence of a thick bed of lignite at Pondicherry some 240 feet below ground-level points to the same conclusions. Evidences of upheaval are furnished by the exposure of raised coral reefs along the coasts (near Pamban) and raised cliffs and beaches (near Cape Comorin).

The sea is practically scouring away the coast line, and encroaching upon land near Vizagapatam, near Royapuram, within Municipal limits of the Madras city, and opposite the Seven Pagodas or Mahabalipuram, thirty miles south of Madras.

The sea has distinctly receded in certain other places notably opposite the Triplicane, and Mylapore divisions of the city and only a few months back, near Aleppey on the west coast, due to the formation of a new mud bank.

The chief geological formations in and around Madras can briefly be classified as follows :—

Beach sands and migrating sand-dunes.

River alluvium.

Laterites (low-level).

Cuddalore sandstone.

Rajmahal plant beds.

Cuddapah outliers and associated Trappean intrusions.

Eparchaean interval.

Charnockite intrusives.

Granitoid gneisses.

Laterite.—Good sections of extensive and fairly thick patches of laterite are well seen (1) near Red Hills (seven miles north-west of Madras), (2) Madavaram village close to Red Hills, (3) along the banks of the Corteliar river, (4) North of Avadi station (M. & S. M. Ry.), (5) South-west of Sembarampakkam tank near Poonamallee, (6) Irumbur near Sripermatur and (7) opposite Trivellore station (M. & S. M. Ry.).

Cuddalore sandstones.—These occur on the northern bank of the Corteliar river as friable brownish grits, separated from the overlying laterite cap and underlying Rajmahal rocks on lithological and stratigraphical grounds.

Rajmahal series.—According to Mr. R. B. Foote, the Rajmahal beds extend over an area of nearly 1,000 square miles, part of this area,

however, is covered up by younger formations. The Rajmahals are seen as four separate patches at (1) The Sattavedu, (2) Alicoor, (3) Pyanoor and (4) Sripermatur areas.

Cuddapahs.—The southern outlier of Cuddapahs forms the well-known Naggery peak or nose capping the Archaean gneisses, and doleritic intrusions are common in this area.

Charnockites.—Exposures are seen at (1) St. Thomas' Mount and (2) the adjoining Pallavaram hills.

The Mount is eight miles south of Madras on the South Indian Railway and there is a small hillock on the western side of the Mount, made up of Charnockite in the centre and flanked on both sides by augite-norite.

The Pallavaram hills are situated three miles further south of St. Thomas' Mount on the eastern side of Pallavaram station and railway line (S.I.Ry.). Here there is a central band of norite bounded in succession on the eastern and western sides by Leptynites and Charnockites. Pyrite is abundant near the Leptynite margin, while graphite is found as an original constituent of norite.

The rocks exposed at the Seven Pagodas (Mahabalipuram) are an aplitic variety of Charnockite and they carry quartz crowded with acicular inclusions, and micro-perthitic felspar. Besides, this locality is deservedly famous for its rock-cut temples and monoliths constructed by the Hindu monarchs of middle ages.

Age		Geological formations
.....		The Sea.
ARYAN GROUP. (Sir T. H. Holland). — Recent	...	Alluvium (Nemer), Deltaic alluvium, Nemer raised beaches, coral banks.
		Cave deposits of Kurnool.
Pliestocene	...	Alluvium (Older), Older Godavary alluvium, low-level laterite, raised beaches.
		Cuddalore sandstone.
Pliocene	...	Laterite (High-level) of Ganjam, Palni and Nilgiri hills.
		Lateritoid deposits.
Miocene	...	(Upper and Middle Miocene locally absent).
(Lower Miocene)	...	Cuddalore series on the east coast, and Warkalli beds on the west coast.
Oligocene	...	(Locally absent).
Eocene	...	(Locally absent).
Cretaceous — Darian	..	Ninnyur Stage: Deccan trap, outlier at Rajahmundry. Aryalur stage.
Cenomanian.		Trichinopoly stage.
Weald	...	Utatur stage.

Mineral deposits
Common salt.
Monazite, ilmenite, zircon, garnet, and glass-sands, alluvial gold, brick clays and diamonds.
.....
Kankar, saltpetre, soda-earth, iron ores, lithomarge.
Building stones.
Building stones, iron ores, bauxite, lithomarge.
Manganese ore, iron ores, ochre.
.....
Building stones, lignite, alum shales, marcasite, and pyrrhotite.
.....
.....
Phosphatic nodules, gypsum, ochre, clays, shell-limestone, building stones (Basalt), agate, jasper, rock-crystal.
.....
.....

Table of Geological Formations, and associated Mineral

Age			Geological formations
ARYAN GROUP—(*concld.*) (Sir T. H. Holland).	Jurassic	Portlandian.	Tripetti, Pavalur beds.
		Bathonian.	Raghavapuram, Sripermatur beds.
		Lias ...	Gollapalli, and Budavada stages.
	Triassic ...		(Locally absent).
	Permian ...		(Upper and lower Permian locally absent).
	Barakar stage ...		Godavary valley.
	Permocar boniferous.		(Locally absent).
DRAVIDIAN GROUP.	Carboniferous ...		(Locally absent).
	Devorian ...		
	Silurian ...		
	Ordovician ...		
	Cambrian ...		
PURANA GROUP.	Torridonian ...		Kurnool series.
	Algonkian ...		Cuddapah system.

deposits of the Madras Presidency—(continued).

Mineral deposits
.....
Different varieties of clay and shale.
.....
.....
.....
Coal, sandstone.
.....
.....
Diamond, limestones, quartzites, shale, barytes, steatite, argentiferous-lead-ore, manganese-ores.
Manganese ores (in part), quartzites, slates, argentiferous-lead-ores, traps (building materials).

Table of Geological Formations, and associated Mineral

Age	Geological formations
Archean system* ...	A. Younger pegmatite intrusions.
	B. Elæolite syenite series.
	C. Charnockites.
	D. Peridotite intrusions.
	E. Peninsular gneiss.
	F. Quartz-veins cutting schistose rocks.
	(Sedimentary ore-deposits).
	G. Kodurites.
	H. Khondalites.

* At the present state of our knowledge, the interrelation any great degree of

deposits of the Madras Presidency—(concluded).

Mineral deposits
Mica, kaolin, garnet, ilmenite, monazite, graphite, molybdenite, rare-minerals, gem-stones, (columbite, tantalite, aquamarine, monazite, cyrtolite, sipylite, zircon, thorianite, cordierite, ruby).
Corundum, spinel.
Building stones, road-metal, ilmenite, monazite, quartz-magnetite ores (confined to Mysore)
Chromite, magnesite, steatite, asbestos.
Building stones, corundum, kyanite, garnet and stawiolite.
Gold, silver, pyrites, pyrrhotite, arsenopyrite, blende, galena, chalcopyrite, stibnite (dominantly found in Mysore, but extends to Anantapur in the north, and North Arcot in the south).
Quartz-iron ores (in part), manganese ores (in part), manganiferous iron-ores, dolomite, manganiferous limestones and marble.
Manganese ores, lithomarge, ochre, apatite, graphite.
Graphite, garnet, building stones.

hips of the various formations touched upon, is not known with learness, or accuracy.

THE AGRICULTURAL COLLEGE AND RESEARCH INSTITUTE, COIMBATORE

The Agricultural College and Research Institute is situated three miles from the town of Coimbatore and about twenty-five miles from the foot of the Nilgiris. It is reached from Madras by one night's journey on the Mettupalaiyam Mail train.

The Institution comprises a Teaching College and a Research Institute with the necessary quarters for staff, hostel, playing grounds, etc. the Central Farm, and three Plant Breeding Stations, the total area occupied being about 557 acres.

Teaching College

This is now housed in a separate building known as the Freeman Building, which was formally opened by His Excellency the Gover

nor in 1926. This building contains a number of well-fitted laboratories, lecture rooms, etc., and is complete in itself.

The teaching college is affiliated with the Madras University and the course of instruction given is one of three years' duration, being a post-intermediate course in agriculture and the related sciences. The science subjects are taught as such but specially in their relation to agriculture. The course leads to a degree of B.SC. AG. of the Madras University. Forty students a year are admitted and there is room for 120 students in all and the College is at present quite full.

Teaching has been entirely separated from research and is carried out by a number of Lecturers in the different subjects, viz., Chemistry, Botany, Agriculture, Zoology, Engineering, and Veterinary. The College and College Estate are under the administration of a Principal who is aided by a Vice-Principal who is also the Lecturer in Agriculture.

The research officers though not directly engaged in teaching are required to give a certain number of lectures each year to the students on

their own particular subjects and the research stations are, at all times, open to the students so that they can acquaint themselves with what is going on.

Central Farm

The Central Farm possesses an area of 232 acres of cultivable land which is mainly used for instructional purposes though some experimental work is also undertaken. A wide range of soils is represented including dry land, both black and red soils, garden land, and wet land. All the principal crops of the Presidency are grown and the students thus obtain practical experience in all the main types of cultivation. Special attention is paid to the practical side of the training and the students are obliged to work on the farm themselves and take part in all cultural operations while they also are provided with plots of their own which they are expected to cultivate. Practical agriculture is a failing subject in the degree examination.

Attached to the farm is an up-to-date dairy where practical dairying, butter making, etc., is

taught. A pedigree herd of cross-bred cattle is maintained at the farm for the purpose of supplying milk to the estate through this dairy. Research work on cattle breeding is carried out on three big cattle farms situated in other parts of the Presidency under a special Live Stock Officer. There is also a veterinary hospital where instruction in veterinary practice is given and also shops for carpentry and blacksmithy.

Research Institute

Investigations in the chief branches of science connected with agriculture are carried out by a number of research officers, comprising a chemist, a systematic botanist, an entomologist, a mycologist, and an agricultural engineer, while plant breeding work is done by a paddy specialist, a cotton specialist, and a millet specialist each of whom has a separate plant breeding station of his own.

The experimental work varies considerably from research on scientific problems of a fundamental nature to a study of the practical application of known scientific facts. In addition

there is a certain amount of routine work such as chemical analyses, seed germination tests, examination of materials sent in for report on insect and fungoid pests and in the botanical section for identification.

The following is a necessarily brief summary of the chief lines of work of the various sections :—

Chemistry Section

The most important items of investigation in hand are—

(a) Soil surveys.
(b) Conservation of soil moisture.
(c) The effect of manuring on crop and seed.
(d) Synthetic farmyard manure.
(e) Experiments with different manures both artificial and indigenous.

Attached to this section is a bacteriologist who is working mainly on problems connected with the solubility of rock phosphates and bacterial problems arising out of the investigation into the manufacture of synthetic farmyard

manure and the rapid decomposition of cellulose and lignin.

There is also an animal nutrition branch of this section in which problems relating to digestibility of different forms of fodder and standard diets are being investigated.

Botanical Section

There is a very large herbarium at Coimbatore on which the Flora of Madras now being compiled at Kew is largely based. Studies are being made in this section of the weeds of cultivated land in the Presidency, of fodder grasses, and of medicinal plants.

Entomological Section

The present research work is confined almost entirely to a study of various pests. An Insectary is attached to the section for the study of the habits and life histories of such pests. Some of the major pests under investigation are paddy stem borer, *calcoris* of cholam, mango hopper, fruit flies, rice grasshoppers, thrips, and

hairy caterpillar. A campaign is being carried out on the biological control of *Nephantis serinopa* on the West Coast by means of its natural parasites.

Mycological Section

Investigation of the fungoid diseases of plants especially of economic crops and the devising of remedial measures form the main lines of work of this section. The following are some of the more prominent crop diseases which are under investigation at present :—

Piricularia of paddy, mosaic disease of sugarcane, *Vermicularia* of cotton, wilt diseases of betel vine, groundnuts, and plantains.

Plant Breeding Sections

Paddy. Work is carried out on the paddy breeding station which occupies about thirty acres at Coimbatore, but this is supplemented by three other stations, one at Adutùrai in the Tanjore-Trichinopoly delta, one at Marteru in Godavari delta, and one at Pattambi on the West Coast.

Improved strains are being raised by single plant selections from all the important varieties while good varieties are also crossed with a view to combining the good qualities of the parents selected for the purpose. These strains are tested in the field by means of a system of plots for which the experimental error has been accurately determined and also on the various Experiment Stations and finally given out to the ryots. Eight of such strains have been issued from Coimbatore and ten from Aduturai while the other two stations are comparatively new and have not yet reached the stage at which a new strain has been evolved.

In addition to this a large number of other problems are under investigation such as the effect of sowing at different seasons, different types of nursery, manurial trials, spacing, cultural treatment, etc. A study connected with the food value of rice has also been undertaken.

On the academic side work is being done at all these stations on inheritance characters and hybridisation is being undertaken. The most interesting phase of this work is the attempt

which is being made to evolve strains resistant to certain diseases.

Cotton. Work is carried out on the cotton breeding station at Coimbatore and on several subsidiary stations in the district. The main object is to produce better strains of cotton suited to different localities both by means of selection and hybridisation.

Some excellent strains of Cambodia have been evolved and these are now grown over very wide areas. Similarly some good strains of Karunganni have been evolved and issued.

Other problems which are under investigation are the best time to sow, manurial work, and cultural improvements.

Millets. A millets breeding station was established at Coimbatore in 1923 under a specialist and good progress has been made and the first of the improved strains which the station is designed to evolve are in sight.

Attention has so far been mainly concentrated on peria-manjal cholam and ragi and both the academic and economic aspects of both these crops are under intensive study. A satisfactory

start has also been made with korra, arika, panivaragu, and kuthiraivali.

Sugarcane. The work of this section is carried out on the Cane Breeding Station, which occupies about fifty-two acres. It is an all-India station started with the object of remedying India's comparatively low outturn per acre of cane. The bulk of India's cane acreage is found in North India and the indigenous canes of that area are in most urgent need of improvement; hence the chief attention of the station is concentrated on work for that area. New types are being raised by growing cane from seed, instead of from cuttings, and crosses are also being made between different varieties. The original difficulties have been overcome and seedlings are now being raised in large numbers.

Among special subject being studied are :— The inheritance of characters in seedlings, the nature of the root-system and the fertility of the flower.

Over 300 varieties, collected in India and other countries, are being grown.

Other Crops. A great deal of research work

has been undertaken with other crops, but this is done on Experiment Stations situated in other places in the Presidency.

Engineering Section

A Research Engineer has just been appointed with headquarters at Coimbatore. He will devote his attention entirely to research and at first the possibility of improved local implements will receive consideration. The different makes of ploughs, etc., now on the market will be critically examined and compared with the idea of discovering a few standard types and if necessary introducing improvements in the makes now available to render them more suitable to the needs of the ryot and different types of soil.

R. D. A.

SOME ANTHROPOLOGICAL PROBLEMS

South India presents a large number of fascinating problems for the anthropological worker. In view of the facts that customs are changing so rapidly before the advance of education, and that some of the tribes like the Todas are fast becoming extinct, there is great need for trained workers who will record existing practices. Unfortunately, since the last session of the Science Congress in Madras no great advance has been made in the field. Recently, however, we have had Rao Bahadur L. K. Anantha Krishna Ayyar's *Anthropology of the Syrian Christians* and Mr. W. J. Hatch's study of the Kuruvas of the Tamil country under the title, *The Land Pirates of India*. The field is so vast and the problems so many that we deplore the dearth of workers.

The Castes and Tribes of Southern India by

Thurston and Rangachari and *The Castes and Tribes of Cochin* by Anantha Krishna Ayyar are valuable as surveys of the principal groups in these areas. Mr. Anantha Krishna Ayyar is placing us under a further debt of gratitude to him by a study of *The Castes and Tribes of Mysore* to be published shortly. If the Travancore Government could see its way to organize a survey in its area, it would complete the larger areas of the south. But in addition to these surveys there is great need for more detailed investigations into many of the individual social groups. As far as the south is concerned, Rivers on *The Todas*, and the two new works by Hatch and Anantha Krishna Ayyar are about the only specialized studies available. The pity of it is that there is little encouragement either from the Government or from the University. Until the University undertakes to train men who are able to conduct scientific work and thus create an interest, there is little chance for real progress.

One of the perpetually recurring problems has to do with the inter-relationship between Dravidian and Indo-European elements in South

Indian culture. The further the problem is investigated, the more complicated it seems to be. It has been assumed by many that South India in language and culture is fundamentally Dravidian, though Indo-European elements have been grafted on. The problem of disentangling the elements from one another is difficult. The truth is, we have no criterion by which to decide what a Dravidian element really is. It is not enough to follow a practice of elimination, and say that any elements in the south that do not appear in the north must therefore be Dravidian, for we know that Dravidian influence penetrated the north also, and further that other causes for differentiation are to be reckoned with, due, for example, to local conditions and events. When the Indo-European invaders entered India, probably by the Khyber Pass, they found at first rather sparsely settled areas. Later as they swept down through the Land of the Five Rivers into the Jumna-Ganges valley, they came into contact with inhabitants who disputed their right to proceed. The word 'Dravidian' is commonly used to describe these peoples, and it is

supposed that the pre-Aryan inhabitants of India in the north as well as the south were Dravidians. We should not forget that the term 'Dravidian' as employed ethnologically is no more than a convenient caption, for the more we find out about the Dravidians, the surer we are that they were themselves admixtures of various elements, including Scythian and Mongoloid and perhaps Negroid. The word 'Dravidian' is derived from an ethnic name *Draviḍa* or *Dramiḍa*, the Pali equivalent of which is *Damiḷa*, the affinity of which with the adjective *Tamiḻ* is apparent. An ancient Tamilian tradition refers to the five Dravidian areas, *pañcha-draviḍam* by which is meant the Tamil, Andhra, Kanarese, Maharashtra and Gujerat regions. Naturally the invading Indo-Europeans took much more time to reach the south than the north, so that there is ground for believing that the south was a stronghold of Dravidian culture long after there had been a synthesis of the two elements in the north. In some instances there were conquests with an enslaving of the earlier inhabitants by the invaders, which is without doubt one of the

origins of the caste system, and is apparent in the fact that some of the lower castes show pronounced Dravidian characteristics, while the Indo-European ascendancy appears in the Brahmanical superiority.

If the tradition about a *pañcha-dravidam* be correct, there should be evidence in support of it both of linguistic and of ethnological types. Such evidence is not nearly as convincing as is ordinarily supposed. Ancient Sanskrit works refer to the Andhra country alongside of the Dravida, and distinct from it. In the time of the *Aitareya Brahmana* the Andhras alone appear to have been known to the Indo-European world. Philologists tell us that in all probability there was an undifferentiated mother-tongue from which the present Andhra and Tamil languages were derived. Kumarila speaks of the *Andhra-Dravida bhasha*. Sanskrit grammars do not refer to any Dravidian group of languages, though they speak of a *deshi* element in distinction from Sanskrit and Pali. The relation between the South Indian languages and the Aryan is one that requires further investigation. As they exist now,

certainly there is a large Aryan element in the southern languages in addition to the non-Aryan element. Some scholars are inclining to the view that the Aryan element in these languages is the original, and that it was later that the aboriginal elements became fused with the Aryan.

There is no gainsaying the fact that there were non-Aryan peoples in South India before the advent of the Aryans. That does not prove that the immediate predecessors of the last Aryan invaders were Dravidians. Several scholars have admitted that the ethnological evidence indicates that the South Indians of the present are much more closely akin to the Aryans than to any other types, Mongoloid, Scythian, Negroid, or what not. Thurston's conclusion is that generally speaking, 'the Dravidian type of head will even bear to be directly compared with the European. . . . The Dravidian heads differ from the English, only in being smaller and narrower with a preponderance in the former of the signs of timidity and subtlety, and in the latter of physical and moral courage.' The conclusions

reached from the standpoint of physical measurements seem to be that South Indian peoples are strongly Aryan. To be sure, there are other elements. The Andamanese islanders show Negroid tendencies, and the Veddahs of Ceylon, some of whom are to be found also in Travancore, show an Australoid strain. The only matter about which we can be certain at the present is that the problems are as complicated as the languages and the cultures.

Another of the vexed anthropological problems is concerned with the diffusion of customs and conventions. We know that both custom and convention are diffused through suggestion and imitation. Here in South India there are multitudes of such social usages that have been sanctioned through custom, and the origins of which are lost in obscurity. In some cases we find practices which affect many different communities, and in other cases those which are apparently local. There are some very interesting problems that await the research student as to the manner in which borrowing has taken place. Where we have relations between two or more communities who have

parallel customs, who was the borrower and who the lender? And under what circumstances did the diffusion take place? Doubtless the similarity between practices is to be explained sometimes on a psychological basis rather than historical.

A concrete illustration will make clear the type of problem to which reference is made. There is a number of interesting parallels between the Kallars, one of the so-called criminal tribes, and the Muhammadans of South India. In the first place circumcision is in vogue in both communities. Secondly, there is a certain amount of polygamy in both. Third, in both communities there is a custom for the bridegroom to go on horseback to the marriage. Fourth, girls are veiled for the marriage ceremony alike in both. Fifth, Kallar girls wear a crescent shaped pendant, suggestive of the Muslim symbol. Sixth, in both communities girls wear black beads. Seventh, there is a custom among Kallars of addressing Muhammadans as 'grandfather,' 'uncle,' or some such term of kinship to which the Muhammadan replies with appropriate terms, as 'grandson,'

'nephew,' etc. Among the Kallars themselves there are two theories as to these parallels, one that they adopted them from their Muhammadan conquerors, the other that both owe the customs to a common source. This is one of the problems relating to diffusion of culture of which there are many, awaiting the investigator.

The various rituals and ceremonials of the religious life further illustrate the problems arising from culture contacts. There is a line of cleavage between two types of religion in South India that is obvious to the observer. On the one hand there is the Brahmanical cult with its associations with literary Hinduism, and to some extent with philosophic Hinduism. But the masses of the people follow a religion that has little more than nominal affinities with the Brahmanic cult. In the villages there are innumerable minor deities who are propitiated in numerous ways to obtain their favour and guard against their caprices. Most of these deities are of local origin as well as one can tell, and are propitiated by bloody sacrifices in which all but Brahmans participate. In fact the very word *grama devata* signifies that the

people regard them as of local origin or function. Most of these minor deities are female, and myths associate them in various ways with the major deities of Hinduism. Some of the female deities are regarded as the *saktis* of the great gods, and in a general sense the term *sakti* is popularly applied to all of these minor goddesses. Other cults have arisen through the veneration of people who while living performed some acts regarded as especially meritorious, or are regarded as having made post-mortem visitations for the benefit or otherwise of the living. Many folk-tales gather around the local deities and their shrines, most of which presumably have a factual basis but suffer from much accretion.

It has been common to speak of these minor deities and their cults as Dravidian. It is exceedingly hazardous to venture how much or how little is of Dravidian origin, since we know so little about Dravidian culture in general. But it seems pretty certain that these local cults represent a social consciousness that characterized the predecessors of the present inhabitants, and probably point back to a period antecedent

to Brahman dominance. We have two studies of this subject, Bishop Whitehead's *The Village Gods of South India*, and Dr. Elmore's *The Dravidian Gods in Modern Hinduism*. Dr. Elmore's study is clearly the more careful of the two, and yet we can scarcely deny that even his title begs the question. At the same time the different interpretations of these students of the subject are an indication of how unworked the field yet is. Dr. Whitehead conjectures that the buffalo-sacrifice in the cult of the *grama devatas* is a relic of totemism, while Dr. Elmore interprets it as symbolizing the dire punishment and humiliation of a conquered enemy. We certainly need to know more about the subject before we can take sides with either writer with any certainty. Dr. Whitehead's hypothesis itself raises another vast problem, viz., the evidence for totemism in South India, a problem which so far has enjoyed nothing more than sporadic attention from students of anthropology.

On the technological side there are many problems also which await the investigation of the scientific worker. Scarcely any excavations

have been conducted in any part of the south though undoubtedly light would be thrown on periods of ancient history and pre-history if such were the case. The Archaeological Department always has the very sufficient reason of 'no funds' with which to carry on extensive work. Even on the surface technology presents problems. Within a few miles of Madras neolithic remains have been found on the surface of the ground in the form of chipped stone utensils, such as lamps. In many parts of South India there are megalithic remains, dolmens and stone-circles the origin and function of which are matters of dispute. Some suppose them to be burial-chambers, while others regard them as places of shelters from inclement weather or wild beasts. A few iron weapons and implements found on excavation lead some to identify these chambers with the Iron Age. Human bones have been found in Travancore dolmens. But we know that the terms 'Iron Age' and 'Stone Age' are very relative. In parts of Assam and in the Ceded Districts of the Madras Presidency stone burial chambers very similar to these dolmens are still

in use. The origin of South Indian dolmens and stone circles is still a problem.

Another set of problems gathers around the mythology current in South India. Puranic literature is a veritable mine of folk-lore, and South India shares with the other parts in this. In addition there are numerous myths associated with the local cults and local communities. One group of stories is popularly known as *The Shepherds' Purana*, and comprises legends current among the shepherds, a distinctly South Indian community. These legends are regarded as of comparatively recent origin, though they are written on palm-leaf books and zealously guarded. The cults and deities to which reference is made in the shepherd legends are not associated with the major gods of Hinduism. In addition we have many legends which are of obvious local origin, being designed to add a sanction to the cult of the *grama devatas*. In some cases such legends are grafted on to Puranic legends, and the story-tellers recount a version of the Puranic tale enlarged sufficiently to afford a place for the local cult, and to connect the deity with

Hinduism proper. This side of folk-lore in South India is practically virgin soil for the investigator.

It need scarcely be pointed out that these problems are inter-related in many respects. Language, social organization, social customs, technology, folk-lore and religion are all parts of a cultural unity, of distinctive interest yet integrally related. Almost any problem that is investigated is sure to throw light on several other kindred matters. To the anthropologist South India constitutes a challenge.

A. S. W.

THE KING INSTITUTE OF PREVENTIVE MEDICINE

The King Institute is situated at Guindy about seven miles from Madras. It was founded in 1903 and named after Colonel W. G. King, C.I.E., I.M.S., then Sanitary Commissioner of Madras, who was chiefly responsible for its inception. At first its main work was that of supplying vaccine lymph to the Madras Presidency, but in course of time its activities have extended very greatly and at present it serves as follows :—

For the whole Presidency—

(1) The only vaccine lymph depot.

(2) The main general bacteriological laboratory for bacteriological and serological diagnostic purposes.

(3) The laboratory for the manufacture of all vaccines except plague, and of sterile solutions and culture media.

(4) The only Government Public Health Laboratory for the bacteriological and chemical examination of water supplies, milk, food, etc., and now includes the laboratory for the Public Analyst to the Government of Madras.

(5) A cold storage and distributing centre for sera for human and veterinary use.

(6) A general clinical and public health research laboratory and the centre for three mobile investigation units.

For all the Madras hospitals except the General Hospital—

(7) The clinical bacteriological laboratory—an Institute car collects material daily.

The Institute covers several acres of ground and consists of a main building for the bacteriological and chemical work, a new subsidiary block for vaccine lymph work and many outbuildings for calves, animals, stores and offices. The Institute has its own water and gas supply,

runs a large cold store and makes its own ice. In the grounds of the Institute there are a set of experimental water filters with storage tanks and sand and mechanical filters.

The staff consists of a Director, two Assistant Directors, the Public Analyst who has powers as an Assistant Director, seven Assistant Surgeons, two non-medical gazetted Senior Bacteriological and Chemical Assistants, one Sub-Assistant Surgeon and five Junior Bacteriological, Chemical and Vaccine Assistants. In addition there is a large staff of laboratory attendants and other subordinates which swell the total staff to 178.

The Vaccine Lymph Section manufactures over two million doses of glycerinated lymph annually. The adoption of Nijland's cycle in 1922, has produced a lymph that has increased in potency every year, and was at its highest last year judging by the general case success rate for the Presidency which was 96·9 per cent.

The climatic conditions contended with in this Presidency are such that it has been found advisable to cease all routine vaccination

operations in the hottest months of the year April to July.

The General Bacteriological Section has been of increasing use to the Presidency and particularly so in the performance of Wassermann tests of which 16,000 were done in 1927-1928, and in the manufacture of stock and autogenous vaccines. From June 1927 to September 1928, owing to heavy demands, 1,560,000 doses of cholera vaccine have been manufactured and 1,344,000 have been issued.

In the Public Health Section the examination and investigation of water supplies has always been a prominent feature. During the course of each year, samples of water from every protected water supply, whether belonging to municipalities, railways, or jails, are collected by the Institute sample-takers, brought to the Institute and examined. Samples from any proposed source of supply are also submitted for opinion and report.

Experiments are being carried out with experimental filters at the Institute and at Kilpauk, under the direction of the Committee on Water and Sewage Purification,

of which the Director of the Institute is the Secretary.

The Public Analyst has fixed standards for certain food supplies with a view to bringing the Madras Adulteration of Food and Drugs Act into operation. In addition to his own work he controls the Public Health Section.

The work done by the MOBILE INVESTIGATION UNITS, the first of their kind to be formed in India, have justified their existence—the annual report for 1926-27 gives a good idea of their activities which extended over fourteen different malarial surveys and bacteriological researches.

The King Institute has a good record of MEDICAL RESEARCH WORK done by officers while working on its staff. The Protozoological researches of Captain (now Lt.-Col.) Christophers while Director are well known.

Medical Entomology has formed a very fruitful field for research in the hands of Majors Patton and Cragg, who worked in collaboration at the Institute for some considerable time. The experience gained by these officers

culminated in the publication of their well-known text-book on Medical Entomology.

The Institute was the head-quarters of the Kala-azar Commission in Madras in 1912.

The interest which has always been taken in problems connected with water purification originated with the work done by Major (now Lt.-Col.) Clemesha while Sanitary Commissioner in Madras. The results of his researches on tropical standards of purity were published in many of the reports issued from the Institute, and formed the subject-matter of his book on 'Water Supplies in the Tropics.'

The field covered in recent years has been a wide one and includes investigations into vaccine lymph, filariasis, kala-azar, relapsing fever, malaria, dysentery, cholera, puerperal sepsis and the purification of water. The results of these investigations by the members of the staff have been published from time to time in Indian Medical Journals and in the Annual Reports of the Institute.

In addition to its official work, the King Institute has taken a prominent part in the Health Propaganda Movement in the Madras

Presidency. Members of the staff have been responsible for the production of much material utilized by the Madras Health Council.

H. H. K.

MEDICAL EDUCATION IN THE MADRAS PRESIDENCY FROM 1835 TO 1928

THE author of this article has in his possession records handed to him by the late Principal, Lt.-Col. Elwes, which give a very clear account of the rise and progress of the Madras Medical College and medical education in this Presidency up to the year 1885. In these documents it is noted that medical education in this Presidency started in 1835. A Medical School was established in Madras by the Rt. Hon'ble Sir Frederick Adam, K.C.B., by a general order of Government, dated February 13, 1835. The school adjoined the quarters of the Surgeon of the General Hospital. The Medical School was built in 1836 at a cost of Rs. 19,861-3-3 and was opened for work in July. It consisted of four apartments, a theatre or lecture room, a library, a museum,

and a laboratory, and a building behind the theatre for the purpose of conducting dissections or preparing parts for demonstration in the Theatre. The establishment of this Medical School was to be intended for the training of medical subordinates which was an epoch in the annals of the department. It placed in the hands of the profession a power to advance medicine hitherto unattainable.

It raised the status of the subordinates to such a high degree, that there was no comparison between the man who passed through its portals and his senior who had not this advantage. The first class which was taken in July 1835 consisted of ten medical apprentices and eleven native medical pupils. All were stipended. Private students were admitted later on. These private students and Government students were given a free education.

The teaching staff consisted of Surgeon Mortimer, M.D., as Superintendent of the Medical School, Assistant Surgeon George Harding as Assistant Superintendent. There were two Assistants, one a Warrant Officer, and the other a Dresser.

Control of the Medical School was vested in the Medical Board. Anatomy and Materia Medica were taught in the first year, medicine and surgery in the second year. The exigencies of the service, however, seldom or never permitted students for years after the opening of the Institution to complete their two years' course of study. They were absorbed into the service according to their position in the class register whether they completed their course or not. Government and private students were absorbed into Government service after about eighteen months of studying. The text-books used in the school were Mortimer's *Abbreviated Notes on Anatomy,* Thompson's *Conspectus,* Gregory's *Medicine,* Cooper's *Surgery.* It is satisfactory to note that even from the birth of the Medical College the importance of clinical work was recognized.

The first anniversary of the Medical School went off with great *eclat.*

The Rt. Hon'ble Lord Elphinstone presided and inspected the school. The Rt. Hon'ble the Governor expressed himself highly gratified with the results of the examinations. It is

stated that 'the momentum of the onward march of improvements' was given by other more powerful influences and other more popular institutions. The idea had begun to dawn on the minds of the authorities that an institution like the Medical School had a higher mission to fulfil than that of manufacturing subordinates for the medical service. In 1838 a set of draft regulations for the admission of private students to the Medical School was publicly notified. From 1835 to 1845 there were 219 apprentices, 201 pupils—total 420 in the eleven years. At first the opening of the school to private pupils was only taken advantage of to a very little extent. In eight years only ten private students came forward and only four remained for a year upwards. The reason for this small number appears to be the very precarious prospects of acquiring a livelihood in medical practice after qualifying.

The second decade was quite a contrast to the one that preceded it, for important changes in the right direction which were progressive in character occurred in quick succession.

In 1846, the Chair of Chemistry was sanctioned. In 1847 the entrance examination became more stringent, a more perfect knowledge of English was required. Two additional professorships were sanctioned—one, Professor of Midwifery and Diseases of Women and Children, and the other of Ophthalmology. Dr. Thomson was the first to hold this appointment. The school staff at this stage consisted of the Professor of Anatomy and Bacteriology, Professor of Chemistry and Materia Medica, Professor of Surgery and Medicine, and the Professor of Midwifery and Ophthalmology.

In 1847 the course consisted of a five years' one, and was reduced to a four years' course later. To the successful batch of students who passed out in 1852, the College, for the first time, granted its diploma of graduate of the Madras Medical College, a privilege which was enjoyed for fifteen years when it became merged into the degrees of the Madras University. Dr. Mortimer was in charge of medical education up to 1841. Dr. James Shaw was appointed the first Principal of the Medical College and appeared to control Medical edu-

cation from 1841 to 1862 in the Medical College. From 1862 onwards students in the third year attended the practice of the 'Lying-in-Hospital' and attendance also at the Eye Infirmary: Up to 1878 the practice of medicine did not attract the Brahmin student and the Medical College suffered as it was deprived of its quota of students from a community famous for its culture and intellectual superiority.

The Convocation Address of the Madras University was given by the Principal of the College in 1878 in which he stated that he failed to see any increase in the number of candidates for degrees in medicine. He stated in twenty years the Faculty of Medicine had produced three Doctors, half a dozen Bachelors and one Licentiate in Medicine out of a population of some 50,000,000 and he noted that the Brahmins have particularly held altogether aloof from the medical profession. From 1850 clinical instruction was regarded as one of the most essential branches of medical and surgical education, and students received their clinical instructions in the General Hospital, in the Eye

Infirmary and in the Maternity Hospital to which students were posted.

In 1885, it is stated, that the method of clinical instruction in vogue in 1850 still remained in practice. In 1850 it was considered intrinsically sound and perfect and no attempt was made in 1885 to improve on it. In 1850 the Medical School was accorded the higher distinction of a College and this change in the designation of the institution added to its professional status. From 1850 to 1858 medical education was under the control of a President of the Medical College, nominated by Government, and a Council consisting of Professors of whom one was appointed to act as Secretary.

The more important events of the College education were that the Professor of Chemistry became also the Chemical Examiner, and the Professor of Botany was also in charge of Materia Medica.

Application was made in 1852 to the Hon'ble Court of Directors for the admission of the Madras Medical College to the privileges accorded by the Royal College of Surgeons of England to Colonial Schools of Medicine. The

College was recognized as a teaching school only in 1855-56 by the Royal College of Surgeons, London.

Edinburgh, Glasgow, Dublin and Aberdeen were applied to for recognition. The medical education in 1855 was placed under the supervision of the Director of Public Instruction. This at the time was considered a great mistake as medical education was to lose the supervision exercised by a body of the most experienced medical officers of the department, a duty that was always honestly and thoroughly carried out by them. It was some years after handed over to the Surgeon-General.

In 1855-56 several students of the College distinguished themselves at Medical Schools in Great Britain. In 1856-57 the Inspector of General Hospitals presided over a Committee of medical officers consisting of three other medical men. This Committee formed a Board of Examiners in Medicine.

The examinations were conducted by the professors in the presence of the Committee. The members of the Committee occasionally put the candidates questions. The Committee

furnished the Director of Public Instruction with a full report. In their report of the examination, they remarked on the course of instruction given, and on other points which the results of the examination might suggest. It was reported by the Committee that only a few of the class seemed to be well-acquainted with practical medicine and chemistry. There was a complete failure in chemistry which the Committee attributed to the method of examining adopted by the Professors of Chemistry. The Committee then re-examined the candidates themselves with the result that the candidates were stated to have acquitted themselves more satisfactorily. The Committee also recommended the complete reorganization of the governing body of the College. 'Each Professor' they observe, 'acts independently and according to his own zeal and industry as his own sense and duty prompts him.'

The Director of Public Instruction agreed with the Committee that the powers and responsibilities of the President of the Medical College should be increased.

In 1857-58 on account of the Mutiny, the

courses of medical education were considerably cut down and most of the students were sent out of the College as Dressers in their second year, those in the fourth year as Assistant Apothecaries.

In 1858 a Principal was appointed to control the College. The appointment of President was abolished. Youths of fifteen years old who had been admitted to the College were now refused. No student was admitted under the age of seventeen by order of Government. The Principal appears to have doubted the advisability of this order and the professors of the College were unanimous as to the advisability of reverting to a system of a preliminary hospital training before the student entered the College. They were of opinion that after a student had two years in a hospital, before they entered College, their character was better formed, became well-disposed for College instruction and would always benefit more by it than they would ever do if they had not had the advantage of preliminary hospital training.

As the growth of education in all its departments increased, the necessity for

enlarging the College building was realized. In 1864, additions and alterations were made. Pathological and Materia Medica Museums were added and a new Theatre for the Anatomical Department was built about this time. The Pathological Museum gradually underwent expansion and in 1868 a museum with a thousand specimens was available for clinical instruction. The Anatomical Department received wax models from Dublin and London and a nucleus for a Comparative Anatomy Museum was started.

A Library for medical students consisting of 187 volumes was available from 1863-64 and in 1867 a general library containing 2,696 volumes and a students' library in which 384 volumes were available. In 1871 there appears to have been a Madras Medical Society which handed over its Library to the Medical College, Madras. They also handed over a sum of money Rs. 1,500, the annual interest accruing thereon was to be spent for the upkeep of the library. In 1872 the library numbered 4,572 books.

The chronicles of this period would not be

complete without reference to the vast tutorial power of the Medical College and efforts were made to turn out a much larger body of moderately competent practitioners, so as to place medical aid within easy reach of the village population of this country. Two schemes were put forward,—Lord Napier's scheme, and Surgeon-General Balfour's scheme. According to Lord Napier's scheme, 4,000 village doctors would be required to meet the wants of this presidency and the question arose, how these 4,000 were to be educated in medical science. It was decided by Dr. George Smith, to whom the matter was referred, that thirty-three to thirty-five pupils was the largest number that could be efficiently taught at one time in the Medical College. It was therefore proposed that five provincial schools be formed, two in the Telugu, two in the Tamil and one in the Malayalam district, that each school was to turn out eight to ten village doctors yearly, that a course of instruction extending over three years should be given in vernaculars, that admission to these schools should be restricted to Vythians and their sons, that the Government pay of village doctors

should be Rs. 10 for the first five years, Rs. 12 for the next five years and Rs. 15 for the remainder of their service and eight annas house rent per month. It is stated that the senior department of the college had proved a failure. This was attributable to the want of an outlet for young men trained in it, that the staff of the professors maintained at the college was not necessary for the teaching of doctors for the mofussil. Two professors and two assistants could quite easily teach what was necessary for those medical men who would be in charge of the mofussil dispensaries, that the village doctor could be trained in two years, that a two years' course should be started for these village practitioners. This seems to have fallen through and small Medical Schools at Dindigul, Nellore and Tanjore were started for training the village doctors.

From 1860 to 1872 medical education took a distinct step forward, and it was divided into three distinct departments thrown open to all, irrespective of creed, colour or caste. Instruction for the Degrees in Medicine was distinct from the Apothecary class and the Apothecary

class was kept distinct from the Hospital Assistants Class.

In 1863, the Faculty of Medicine, Madras University, which had been in existence some years, claimed the exclusive right to grant degrees, and all who wished to obtain degrees must pass through the University. Preliminary standards were raised, better educated youths were encouraged to join the medical profession.

From 1872 candidates who obtained the Degree of M.B.C.M. were required to have graduated in Arts before receiving the degree of M.D. Medical education in this presidency continued to steadily improve, the reputation of the Madras Medical College rose steadily, former students were successfully competing for degrees and diplomas in England, and for commissions in His Majesty's British and Indian medical service.

In 1870 the Faculty of the University of Edinburgh agreed to recognize the teaching and courses at the Madras Medical College and agreed that candidates for degrees in medicine would be allowed to pass two of the four *Anni Medici* required by the Edinburgh regulations.

It is quite clear that the reason for the unpopularity of the study of medicine before 1872 was clearly the want of sufficient outlets, the only outlet at the time being the Indian Commission Medical Service which was opened to Indians just as it was to English candidates; but the expense of going to England, and the uncertainty of being successful in the competitive examinations, made it a very serious consideration and many of the students possessed neither the means nor the inclination to go to England and compete.

In 1875 Government sanctioned the admission of lady students to qualify for the Degrees of the Madras University or for the College diploma. The University of Madras instituted the degree of Licentiate of Medicine and Surgery. In 1875 the requirements were less exacting than the M.B. and corresponded to an L.M.S. degree given in Calcutta and Bombay. The L.M.S. degree has been recently abolished.

In 1877 education in the M.B. class became greatly restricted by order of Government. The object was to take a much larger number of students to the service of Apothecaries and

Hospital Assistants, but it was interesting to note that there was no restriction made on ladies who wished to apply for medical education. However, the order of Government was not to remain long in force. A meeting of the inhabitants of Madras under the presidency of the late Hon. J. G. Coleman was convened and a memorial, dated September 15, 1877 asked Government for reconsideration of their order. The memorialists expressed themselves ready to pay for the education hitherto given gratuitously. The memorial appeared to have been successful in 1878. Registration fees and College fees were levied—the student for the M.B. course paying Rs. 600 and for the college course Rs. 400. These fees included all collegiate, hospital, and clinical instruction required by the University of Madras for the medical degrees.

1878 marks an epoch in the history of medical education. Four ladies passed out from the Medical College entitling them to practise various branches of the profession. Since 1880 the final examinations for students in the Apothecaries and Hospital Assistants class

have been conducted by a Board of Examiners specially appointed for the purpose. This was a great improvement on the old Examining Board as examiners from outside the college were appointed in addition to the professors who taught. In 1880-81 there appears to have been a complete revision of the classes, re-organization in the Anatomy Department, and in Surgery, Physiology, Midwifery, Materia Medica and Jurisprudence. This appears to have been due to recommendations made by the University. Dental Surgery was taught in 1883. Mr. Gould was the first Professor of Dental Surgery. In 1882-83 the Hospital Assistants class ceased to be trained at the Medical College and they were transferred to Royapuram Auxiliary Medical School. This was brought about in consequence of the candidates of this department generally lacking those educational advantages which would enable them to follow the lectures given by the Professors, for the University and Apothecary courses. In 1883 students were required to undergo practical instruction in vaccination. In 1883 attention was placed on the physical develop-

ment of the students. A Boat Club was started and out-door games. A Reading Club was also started to which fifty students subscribed Rs. 96. Professional journals and newspapers were taken in and a common room in the College seems to have been started.

In 1883 the Government of the Straits Settlements sent students to the college to be trained and paid Rs. 400 for the course.

The college which was originally built in 1836, considerably enlarged in 1867, was found in 1883 not to be nearly large enough. It was decided that a hygiene department and new dissecting rooms and lecture rooms were necessary. Several scholarships and prizes were conferred in this college. His Highness the Maharajah of Travancore founded the Bharati Lakshmi scholarships by endowing the college with the amount of Rs. 6,000 to be held by a woman who was qualifying for the medical degree. In this year, Mrs. Scharlieb, a former student in this college passed with high honours the M.B. degree of the London University. She took the highest place in the first class in Obstetric medicine and obtained the gold medal

of the London University. The education of women in India in the medical profession was started in Madras. The Principals of the Calcutta and Bombay hospitals wrote to the Principal, Madras Medical College, regarding the female classes in this college. They wished to know whether any difficulties were experienced in conducting their education. The Principal appears to have advised Calcutta and Bombay to start classes in their Medical Colleges for ladies. In 1884 there were 182 students studying in the Medical College. It is interesting to note the various numbers at this period. There were seventy-nine Europeans and Eurasians, twenty-five Brahmins, forty-seven Sudras, two Parsees, three Mohammedans and twenty-six Indian Christians. The Europeans formed three-fifths of the total attendance. The presence of so many Brahmins indicated a 'great decline of the prejudice of the high class of Hindus to the exercise of the art of healing'. This is in some way due to the Convocation address of Surgeon-General Fernell in which he brought forth convincing arguments to upset their deep-rooted prejudices. Young Moham-

medan gentlemen do not appear to have come forward very freely to study medicine. The total receipts of the college fees of 1878-79 down to 1884 was Rs. 58,695-10-2 and the expenditure during the same period Rs. 3,83,717-8-7.

Dr. Robert Cole who once held the appointment of Principal Inspector of Hospitals, contributed a very useful article in the *Journal of Literature and Science*, volume vii, on the Madras Medical School. He considered the introduction of a systematic plan of education in medicine as carried out in the Medical College, Madras, as the most important stage that had yet been accomplished in the mental improvement of the people in Southern India.

In 1885 the fiftieth anniversary of medical education at the college was celebrated, Brigadier Surgeon Keess reading a very full report. There were 215 students in the college —amongst these were eleven lady students under training. Each Professor appears to have made a report which was read at the annual meeting. Professor Branfoot reported that 'the conduct of this class in college has been good, but, while at the Lying-in-Hospital several of these

students were wanting in proper discipline and respect to constituted authority'.

The Principal stated in his report that the students' clubs were working satisfactorily and helped to maintain a very desirable *esprit de corps* amongst the students and moreover they decidedly contributed to lessen the tendency to the formation of clique based on nationality and general religion. The report goes on to state that after fifty years 1,523 students have passed out as medical subordinates for the service of Government, thirty-four have become graduates of this college, thirty-eight have taken University Degrees, thirty-two have been partially educated here and left for further training in Europe making a total of 1,647. He states in his report that those responsible for development and progress in the college were aware that there was need for further advancement to keep it abreast of modern progress and if possible in the forefront of kindred schools in Great Britain and elsewhere. Government apparently agreed with him and sanctioned a sum of Rs. 75,000 to improve the Medical College and provide a Physiological Laboratory, a museum and a

laboratory for Hygiene. It was recognized that the science of preventive medicine was justly reckoned in all civilized countries as one of the most important in the domain of medicine. The Principal appealed to the public saying, 'I would fain hope that the time is not far distant when wealthy philanthropists will see their way to instituting research scholarships which will encourage scientific investigations and enable highly trained medical graduates of our Universities to spend a portion of their career in prosecuting enquiries in the wide field of causation and treatment of morbid states, and in their practice, testing the value of the numerous indigenous drugs which are reputed to be efficacious in the treatment of disease.'

The Professors during the first fifty years of medical education in Madras who left their mark, were Professors Mortimer and Hæding, Directors of Medical Education in the college, Dr. Keess, Professor of Chemistry, Dr. Blackloch, skilled clinical teacher in medicine, Dr. Chipperfield, Anatomist and Physiologist, Dr. Shaw, the most popular Physician and Surgeon at the time; Dr. Smith whose energies were

devoted to the advancement of medical education, Dr. Evans, a sound and thoughtful physician and teacher; Dr. Mayer, a great teacher of Chemistry, Dr. Listin Paul, an able teacher; Dr. Harris, leading Gynaecologist and Obstetrician in Madras who was the first to be appointed to the Government 'Lying-in-Hospital', Dr. Fernell, who is associated with the discovery of chloroform, Dr. Henry King who succeeded Fernell as Principal and Dr. Price.

The history of medical education in this presidency up to 1885 shows that it was highly successful as far as it went. It must be remembered in 1858 the great Virchow lived and in 1862 Pasteur and Lister were making their discoveries. Medicine was advancing rapidly and becoming highly scientific. The history of medical education in Madras during the last forty-three years has been one continuous progress.

I think all will agree with me that officers of the Indian Medical Service have been chiefly responsible for the teaching and progress of medical education in this presidency. The future of medical education will continue to prosper, and

will be in the hands of the Provincial Medical Service and private practitioners, and a handful of I.M.S. officers. The Professors who have controlled the teaching of the various departments from 1835 to 1928 have put their heart and soul into the work.

The Medical College and the Madras University are now associated with the teaching of medicine in degrees with another University —the Andhra University with its Medical College at Vizagapatam. The Medical Schools at Tanjore, Royapuram, Vizagapatam, and Calicut, the Lady Willingdon Medical School, Madras and the Medical School at Coimbatore undertake teaching for the Sub-Assistant Surgeon Class. University medical education is confined to the Andhra and Madras Universities, each of which gives their own degrees. At present they hold a joint examination. There are proposals for having separate examinations. The Medical College still issues a diploma but this diploma will soon become defunct. The Medical Schools still grant the diploma to the Sub-Assistant Surgeon after an examination held by a Board appointed by Government.

This diploma of Sub-Assistant Surgeon will probably be abolished and a State qualification be substituted after a five years' course. It is interesting to note that the Madras University have always striven to keep their regulations and standard of examinations up-to-date. Between 1910 and 1928 the regulations have been changed seven times. During the last year, 1927, the regulations were brought up-to-date to conform with the requirements of the General Medical Council of Great Britain.

The departments of Hygiene, Pathology, Biology, Pharmacology, Physiology, have all been brought up-to-date, as far as possible. New buildings are about to be erected and will make the Medical College, Madras, one of the best in the East. Great improvements in the hospitals attached to the Colleges and Schools are also under construction. This will assist greatly in improving and bringing up-to-date, clinical teaching. Those who were responsible for medical education and have left a reputation in this Presidency during the last 43 years were : Branfoot, Maitland, Brown, Donovan, Giffard, Elliot, Niblock, Symons, Rama Rao,

Kirkpatrick, and Elwes. All were great clinical teachers in their special subjects.

Madras is especially fortunate in having two of the finest hospitals in the East, namely, the Ophthalmic Hospital and the Women and Children's Hospital. Both these institutions are the envy of all who appreciate the value of unlimited clinical material for teaching in Ophthalmology, Obstetrics and Gynaecology. Probably in no other hospitals in the East or in Europe, is such abundant clinical material available. The whole question of the formation of a teaching cadre and the teaching of specialists to fill the vacancies in the colleges and schools is now under the consideration of Government. Special departments for Children's, skin, throat and venereal diseases and tuberculosis, have all been started. The most up-to-date Pathological, Bacteriological and Biochemical and Hygiene Institutes will be erected shortly at the Medical College, Madras. This will assist to keep the teaching up-to-date, and advance the science of medicine in this country. The spirit of research, keenness, and advancement, appears to be in the minds of all, and I

have no doubt that, with this spirit prevailing, advancement of medical education in the future will continue as it has done in the past. Much could be written about the improvements which have taken place from 1885 to 1910 and from 1910 to 1928. It is gratifying to know that all the recommendations recently made by the General Medical Council to bring the Madras University courses up to the standard required by the General Medical Council have been carried out.

This Presidency is very fortunate in having for the last five years a Governor, His Excellency Lord Goschen, who was for many years Chairman of Guy's Hospital and so is familiar with medical education and clinical teaching in hospitals. Under the advice of the Surgeon-Generals, the Ministers have brought about, greatly to the benefit of medical education, great changes during the last five years in the teaching by the appointment of the whole-time Professors ; great efforts are now being made to improve the General Hospital and the various departments in the Medical College. We have now in the Medical College over 650 students

in the various departments. Over 500 of them are studying for medical degrees. There are 71 lady students.

In one year now, as many graduates pass out from the University in Medicine, as passed out in the first fifty years of the life of medical education in this Presidency. When I say that 23 new appointments have been made in the college during the last three years, it will be understood that every department is expanding rapidly and carrying out the necessary teaching required now-a-days. The advance of medicine, surgery and midwifery is conditioned by contemporary progress in every branch of science, and their virtue lies in the number and vigour of their allies. Biology, Physiology, Radiology, Biochemistry, Bacteriology, Physiology, and Pharmacology are all well-equipped departments under whole-time Professors, and Pathology will shortly be so. With their efficient aid, the Physician and Surgeon can do his best for his patient and keep his teaching up-to-date. The future progress of medicine in this Presidency depends on the efficiency of its medical colleges and schools.

We do not know what situation will be created in the future. Therefore, those associated with medical educational problems should prepare the rising generation to meet a change in any unknown directions in the future. We realize in Madras that, to be taught in an efficient and well-equipped Medical College, working under skilled Clinicians and College Professors, is the best way to turn out scientific medical men who will advance the progress of medicine and medical education in this country.

C. A. F. H.

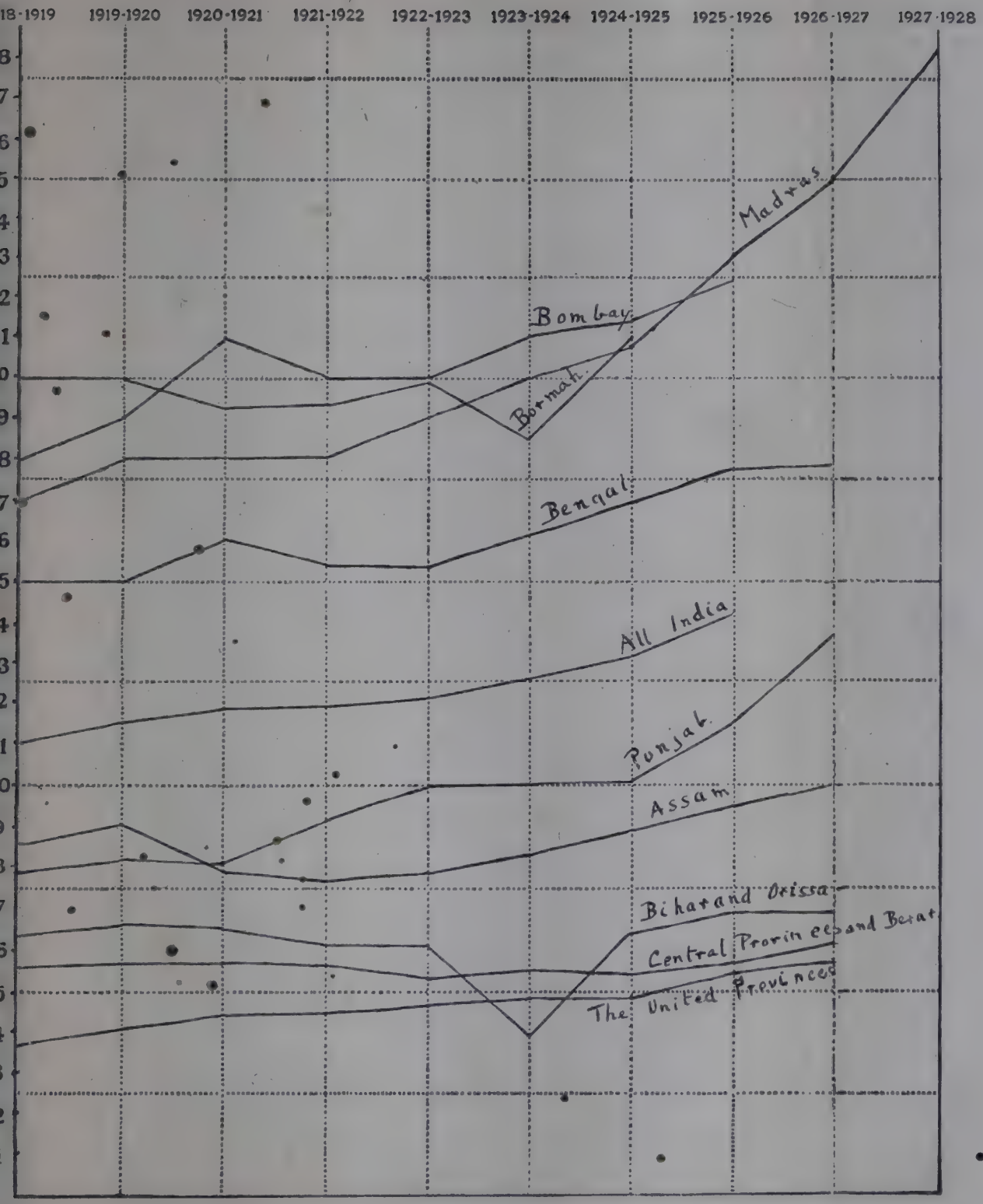
WOMEN'S EDUCATION IN MADRAS

WOMEN'S education in this presidency is considered to be more advanced than in many other parts of India. A statement of the position which will show how far this assumption is justified may perhaps be of interest.

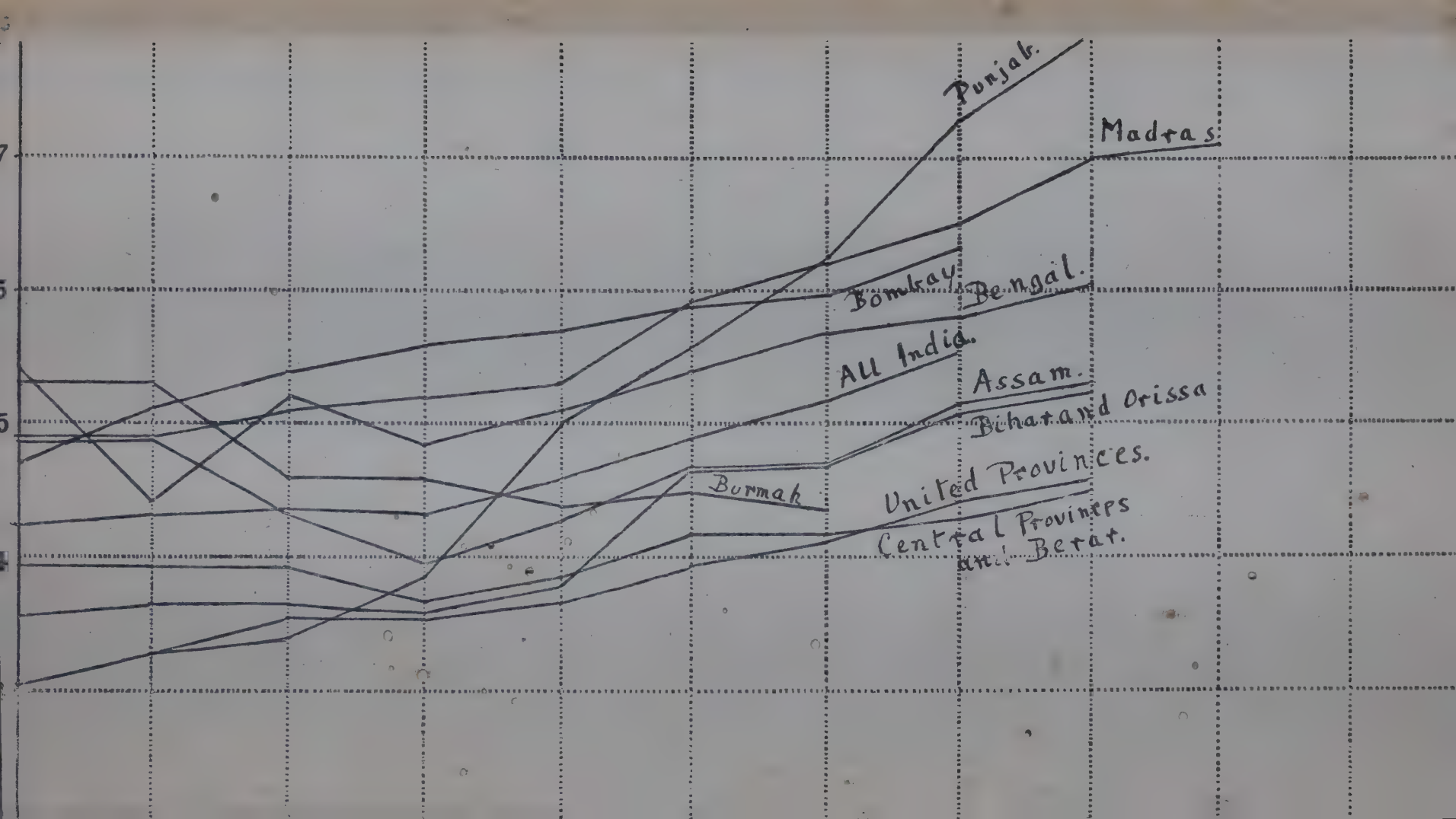
In appendix I a graph is given which shows the percentage of the female population in public institutions in all India and in the larger provinces during the last nine years. Figures for Burmah after the year 1924-25 and for Bombay after 1925-26 are not readily available and the graphs cannot be completed for those provinces while that for Madras only can be completed for the year 1927-28. This diagram shows that Madras during the last decade has been one of the four provinces in which the percentage of the female population reading in public educational institutions has been above that for all India, but, that until the

year 1923 both in Bombay and Burmah the percentage of the female population attending schools and colleges was greater than in Madras. It was not until 1925 that Madras surpassed Bombay in this respect but in 1926-27 it was 2·5 per cent and ahead of all the other provinces. This position has not however been maintained. While the actual figure for Burmah is not available it has now surpassed the Madras Presidency and the percentage of female population in public institutions in that province is higher than in any other province in India. It will however be seen that with the exception of the years 1920-21 and 1921-22, which was a time of acute financial stringency the percentage of the female population under instruction has risen steadily and with increasing rapidity especially in the latter years of the period. From this point of view the progress in the development of the education of women and girls in the Madras Presidency during the last decade must be considered satisfactory but that it has been surpassed by Burmah.

One of the most unsatisfactory elements in the progress of education in India is the marked


1918-1919
1919-1920
1920-1921
1921-1922
1922-1923
1923-1924
1924-1925
1925-1926
1926-1927
1927-1928
Madras
Bombay
Burma
Bengal
All India
Punjab
Assam
Bihar and Orissa
Central Provinces and Berar
The United Provinces

APPENDIX I.


Punjab.
Madras
Bombay
Bengal.
All India.
Assam.
Bihar and Orissa
Burmah
United Provinces.
Central Provinces
and Berar.

and growing disparity between the stages reached in the progress of education for girls and boys. Development in girls' education even if marked and steady cannot be considered satisfactory so long as it continues to lag behind that of boys. Appendix II shows the disparity between girls' and boys' education during the same period, i.e., 1918-19 to 1926-27. From this it will be seen that there is only one province in India, the Punjab, in which the disparity between the education of the two sexes is greater than in Madras. In this respect the position in Burmah appears to be more satisfactory than in any other part of India. In this province alone is the disparity less at the end of the period than at the beginning and further the diagram shows that with the exception of the year 1923-24 the decrease has been continuous throughout. This is however due to a decrease in the percentage of the male population in schools and not to a specially satisfactory condition of girls' education. Between 1918-19 and 1925-26 the percentage of the female population in schools in Burmah only increased by ·9 per cent. Figures for

1927-28 are available only for Madras but these show that as a result of these special efforts that have been made, which include the subsidizing by Government of 500 new elementary schools for girls during the year 1927-28 and the opening of more training classes for women, the rate of increase in the disparity between the percentage of the male and female population in schools and colleges is less than it has been at any time during the last ten years. In Madras the extent of the disparity is not due to any slackening in the rate of development in girls' education but rather to the very concentrated efforts which have been made successfully, to extend education among boys as rapidly as possible. In the Punjab this is not the only factor that has affected the rate of increase of the disparity. The rate of increase in the percentage of the female population at school in this province is less between the end of the official years 1924-25 and 1925-26 than in the years immediately preceding and this accentuates the rate of increase in disparity.

Turning to a comparison of the proportion of the female population in each of the provinces

which is reading in colleges and high schools, we find that in 1924-25 (the latest year for which figures are available for all the larger provinces) that 31 out of every 100,000 female inhabitants are undergoing University education in Bombay, in the Punjab the corresponding figure is 8, while in Madras and Burmah only 2 out of every 100,000 women are receiving a University education. For Bengal the corresponding figure is 1. The total number of women students reading in colleges in Madras was 477 and was larger than in any other province. In Madras also there were more colleges intended solely for women, there being five such colleges. In Bombay and Burmah there were no women's colleges at that time. The differences shown in this respect are due to the fact that *purdah* is not observed among a considerable section of the community in Bombay and that hence the women of the provinces have been able to attend the men's colleges and have not been dependent on the institution of special colleges for women. In the Madras Presidency and the Punjab where the custom of observing *purdah* is more widely spread the

institution of women's colleges has enabled them to make progress equal to or in excess of that of the other provinces. In the Punjab there were two women's colleges in 1924-25.

In the same year in Burmah 154 members of the female population out of every 100,000 were attending secondary schools. In Bombay the corresponding figure was 95, in Madras 57, in Bengal 35, in the Punjab 29 and in Assam 28. In this respect Madras stands third in the list and is surpassed by Burmah and Bombay. The difference between Burmah and Bombay and Madras is again partly a question of social custom, the habit of early marriage among the Hindu community which forms approximately 89 per cent of the total population makes the development of secondary education exceptionally difficult. Madras was also much less well provided with secondary schools than were the other two provinces. In Madras there were approximately 2·7 secondary schools per million female inhabitants, in Bombay there were 5 and in Burmah 8.

Since 1924-25 the position in Madras has only improved slightly in regard to the per-

centage of girls in colleges and secondary schools. In the year 1927-28 the number of women in colleges rose to 2·4 per 100,000 female inhabitants and in secondary schools to 65 per 100,000 female inhabitants and Madras is thus still behind the position reached by the Punjab and Bombay in University education for girls in 1924-25 and behind Bombay and Burmah in secondary education in that year. The number of high schools has only increased by 2 since 1924-25.

Madras has thus been surpassed by one or more provinces in all points, in the percentage of female population attending educational institutions, in the decrease in disparity between the education of boys and girls, the percentage of the female population which is reading in colleges and secondary schools and in the provision of secondary schools per million of the female population. Madras has however a much larger problem to tackle than Bombay, the Punjab or Burmah where the female population is 9·4, 8·8 and 5·9 millions respectively. (The figures are from the census of 1921.) Madras however surpasses in all these

points the larger provinces of Bengal, the United Provinces and Bihar and Orissa all of which are more comparable with Madras in the size of population. Madras has approximately 21 million female inhabitants, Bengal and the United Provinces 22 and Bihar and Orissa 17.

The chief difficulty that has stood in the way of the development of women's education has been the indifference and in some sections of the community, even hostility, to the education of girls and a consequent shortage of women teachers. This difficulty is now rapidly disappearing and there is an increasing demand from all classes of the community for better educational facilities for girls and where these have been provided during the last two years a very good response has been made. There are also indications that a rapidly increasing number of women are ready to take up the teaching profession if adequate facilities for training them are provided. Seven new training classes for women were opened in July 1928 and the number of new students admitted into these schools was 147.

Another fact which very seriously hampers the development of women's education, especially of the secondary and collegiate grades, is the custom of early marriage in the Hindu community and the observation of *purdah* by the Muslim women. Among the Christian communities which are not hampered by either of these customs 11 per cent of the female population is attending public educational institutions. Of the Muslim female population 5 per cent were in schools and colleges during the year 1927-28 while among the Hindu women and girls only 2 per cent were receiving education. In the Madras Presidency it is the Hindu section of the community, which represents approximately 89 per cent of the whole female population, which is most backward in the matter of girls' education. There were however in that year 31 per million of the Hindu female population receiving secondary education in Forms IV to VI while the corresponding figure for the Muslim community is only 19. In colleges there are 10 Hindu women per million Hindu women and 4 Muslim women per million Muslim women. The measure of educational

progress cannot be made with reference to the percentage of the female population receiving education alone. Progress can only be considered as satisfactory when a proportionate development in all three grades—primary, secondary and university—is shown and in this respect the education of Muslim women is less advanced than that of Hindu women. One of the most unsatisfactory features of education in India as a whole, both for boys and girls, is the high percentage of pupils who are reading in the two lowest classes and who do not succeed in becoming permanently literate. In Madras on March 31, 1928, 79 per cent of the girls attending school were reading in Classes I and II and of these 62 per cent were in Class I. While in the initial stages of progress in the development of elementary education for girls the numbers in Class I will be inflated, since all pupils coming forward for education must start in Class I. The percentage of girl pupils in Classes I and II has risen from 75 per cent on March 31, 1927 to 79 on March 31, 1928, and is a fact which merits very serious consideration.

The existence of a laboratory in a given subject is not by any means a guarantee that the scientific method prevails in that field. The recognition of psychology as a science depends more than anything else upon the temper of the men who are engaged in the investigations of the subject. A science is the work that is carried on by men of the scientific temper. That means that psychology may claim to being scientific in so far as her students and teachers have eliminated themselves and their feelings, and are devoting themselves dispassionately to the tasks of observation, experiment and classification of the data of the mental life. It means also that the other sciences have to come to psychology for the only possible basis on which to define and differentiate scientific from other disciplines. In the last analysis a scientist is a scientist, not because of external accretions of any sort whatever, but because of his mental make-up. To the extent that there are being developed in South India men of scientific acumen, absolutely devoted to the search for the truth about the mental life, determined to allow no pre-judgements to warp their judgements, to

that extent may we claim that psychology is developing scientifically. For no science, chemistry, geology, psychology, or anything else, has any existence apart from the men who are giving their lives to the investigation of its problems. If we look over the scientific world to-day we submit that from this most important point of view, the right of psychology to be ranked as a science stands indisputable.

Psychology lays no claim to have finished with the method of trial and error, and to have arrived at final conclusions. In regard to many matters we are in the hypothesis stage, and within our own ranks are men who hold widely differing hypotheses in regard to some subjects. There are the behaviourists who seem to think that they are not being scientific unless they have reduced psychology to physiology, while their opponents are quite as convinced that it would be unscientific to rule out consciousness. It is quite conceivable that the future of psychology lies in a synthesis of the methods employed and points of view expressed by what are to-day regarded as different schools. The neurological-psychologist, the behaviourist, the mental-

tester, the psychoanalyst, the introspectionist, and the Gestalt psychologist each has a contribution to make. The mental life is exceedingly complex, and includes vital facts as well as mechanical, motives as well as chemical processes, aspirations as well as biological habits, social data as well as personal. The technique by which all this data is to be examined must be adaptable enough to deal with all the multiformity that appears.

The psychologists of to-day are following the typical scientific procedure of investigating particular problems. It requires actual, concrete problems to stimulate scientific work. The field of each science is delimited by the definite group of phenomena which it seeks to explain. It adds to its knowledge of that field a bit at a time by facing the problems at hand individually. Its tools and its techniques are instruments to help in its problem-solving operations. There is a great variety of students using the instruments of psychology to attack special problems, and the field of its application is constantly growing wider. The social scientist, the anthropologist, the student of animal behaviour,

the educationalist, the economist, the criminologist, the psychopathologist, the moralist, the student of religion and others are all discovering in psychology a method and a technique invaluable for the investigation of particular problems within their respective fields. There is a vast field awaiting the patient investigations of a host of psychologists here in South India. There are matters economic, religious, social, political, educational, etc., to which students of the future will increasingly apply psychological methods. The task of to-day is to train men to use psychological instruments scientifically to aid in the solution of some of the urgent problems with which we are now confronted.

A. S. W.

unchanged cow's milk. Consequently, unless rejected by vomiting, the curd of the milk passes through them undigested; their wants are not supplied, and they starve for lack of nourishment, although swallowing every day a quantity of milk which would furnish ample nourishment for stronger and older children. In fact cow's milk food is the natural food of calves, but when unmodified is quite unsuitable for infants.

Cow's Milk must therefore be modified before it can so closely resemble breast milk in chemical composition and physiological properties as to be suitable for an infant's use. Since cow's milk contains more caseinogen and less water and milk-sugar than human milk, it becomes necessary to reduce the proportion of the former and to increase the other ingredients mentioned.

Diluted Cow's Milk alone not a good substitute for Breast Milk. By dilution with water, the proportion of proteid matters may be reduced so as to represent those in human milk, but the indigestibility of the casein is not in the least overcome, and this undesirable property must be remedied in some other way, since the proteids are of the utmost importance in the nutrition of infants. The amount of milk-sugar, already smaller in proportion than in breast milk, will be further reduced in the diluted cow's milk, and the mixture will in most cases be acid in reaction instead of alkaline. Heat and force-producing food-stuffs, which are represented by milk-sugar, are absolutely necessary for healthy life and growth. Infants cannot obtain milk-sugar from starchy foods, nor must cane-sugar be regarded as a satisfactory substitute for the sugar-of-milk, in which cow's milk is naturally deficient. When cane-sugar is employed, it gives rise to acidity and impedes digestion. While the amount of ash in cow's milk somewhat exceeds that in breast milk, it has been found that the relative amount of potash salts is greater in the latter than the former; this deficiency of potassic salts must therefore be supplied.

Indigestibility of the curd of Cow's Milk. Perhaps the most important difference in food value to the young infant between cow's milk and breast milk is due to the denseness and leather-like nature of the clot formed by the curd of the former. Ample dilution with water does not affect this property. Under the action of the digestive organs, the particles of casein run together in solid, compact lumps. This is not the case with milk from the breast, for this forms a light, loose, flocculent clot, which is readily disintegrated and digested. The difficulty which even the strongest children find in digesting cow's milk is shown by the masses of hard curd which a child fed exclusively upon a diet of cow's milk usually passes daily from the bowels. This difference between the two kinds of milk is answerable for much of the trouble and disappointment experienced when attempts are made to rear infants by hand upon cow's milk.

How Cow's Milk may be rendered like Human Milk and fit for the use of a Babe from Birth. In order that cow's milk may be rendered easy of digestion and similar to breast milk :—

1. The curd must be made easily digestible and the proportion must be reduced.
2. The carbohydrates must be increased.
3. The fluid must be rendered alkaline.

Mellin's Food entirely fulfils the conditions which are necessary in a perfect food adaptable for the use of infants from birth. It is easily prepared, supplies in a suitable form the deficiencies of cow's milk, makes the casein readily digestible, and the milk alkaline ; and it is entirely free from starch and consequently produces a perfect substitute for breast milk.

CHAPTER V.

THE FEEDING OF HAND-REARED INFANTS.

Where an Artificial Food is required. In considering the question of the artificial feeding of infants, we have three distinct classes of cases to deal with.

Firstly, those hand-reared from birth ;

Secondly, those who have to be weaned unduly early ;

Thirdly, those who are weaned under normal conditions at the age of about ten months.

For all such infants, cow's milk modified is the only proper substitute for mother's milk.

The two great advantages possessed by Mellin's Food are—that it is perfectly free from starch and that it makes cow's milk more digestible, rendering it like breast milk. When added to water or milk it dissolves and does not tend to thicken the liquid even on boiling, as starch-containing food substances will.

The Proportions must be varied to meet the needs of the Infant. These properties render Mellin's Food pre-eminently adapted for preparing an artificial diet for a child during the whole of that period of its life when its food should, in the course of nature, be wholly or

chiefly milk. All that is necessary in adapting it for the needs of children of different ages is to vary the amount of the Mellin's Food employed, according to the age of the infant.

The Importance of Variations in Diet. Children of the same age and parentage vary so much that it is impossible to prescribe exact quantities of food which will meet the bodily demands in all cases. All that can be attempted in the following is to give such general rules as have been found, by wide experience, to work well in average cases. What is well adapted to the requirements of one babe may not suit another, and a careful nurse when she sees the child fretting on food of one strength should gradually vary the proportions. At the same time it must be borne in mind that it is most undesirable that changes should constantly be made and experiments tried from mere caprice.

Care of the Milk. It is of the very greatest importance that the cow's milk which is to be employed in preparing an infant's diet should be of good origin, and when once in the house care should be taken of it until it is used. It must be kept in a cool place, covered over, so as to prevent flies, dust, etc., settling on it. Flies come from all kinds of undesirable places, and may carry from dust-bins, manure heaps, and decomposing materials many kinds of germs, which will grow and multiply rapidly in milk, and these may give rise to diarrhœa. In India, for the reasons given above, the milk should be boiled. As an alternative, the milk may be scalded by standing a cup of milk in a saucepan of boiling water, and leaving the same to stand without putting it upon the fire, or the milk may be kept sweet by placing it upon ice, or standing the containing vessel in cold water.

The Value of Mixed Milk. The milk from a herd of cows is generally more satisfactory than the milk from one cow. It is more constant in composition, and

is less likely to exhibit those variations which present themselves in the milk from one cow.

The Water to be used. The water should be boiled and allowed to cool before being used for mixing the baby's food.

Importance of Cleanliness. It cannot be too strongly urged that the most scrupulous care should be taken to secure the cleanliness of all jugs, pots, cups, spoons, measures or other utensils which may be employed in the preparation of an infant's food. Many cases of diarrhœa and sickness result from a want of care in this direction.

Objections to Feeding Bottles with Tubes. Perhaps no more common source of danger to bottle-fed infants exists than that which arises from the kind of bottle employed. The only permissible form is the slipper or boat shape, without tube; under no circumstance should a bottle with a long rubber tube be used.

In the recently issued Report of the Inter-Departmental Committee on Physical Deterioration it is stated that "a pure supply of milk may be rendered injurious by dirt in the house, the proximity of contaminating articles, the general ignorance, in fact, that prevails as to how milk should be stored and the conditions under which it is fit for use. One fertile source of contamination was said to be the use of the feeding bottle with a long india-rubber tube, which it was impossible to keep clean. Dr. Hutchinson said he would like to see this tube made illegal, as he believes it is in France, and is certainly in some of the States of America."

The Mellin's Feeding Bottle possesses the following advantages:—

When in use the contents are kept in contact with the teat, without an air space, until the bottle is emptied; and the swallowing of air by the child is avoided; also, being egg-shaped, the bottle is easy to cleanse.

The bottle is graduated to show both tablespoonfuls and the quantity of mixed food required by children at different ages, and thus it facilitates artificial feeding.

The valve for the admission of air is constructed so as to preclude the possibility of leakage, at the same time admitting air only so gradually as to satisfy the suction power of the weakest child.

Importance of Cleanliness of Feeding Bottles. It is of paramount importance that the feeding bottle be kept scrupulously clean, and the cleanliness of the Mellin's Feeding Bottle is most easily secured. The best plan is, without doubt, to have two bottles, and after one has been used it should be at once washed thoroughly in running water, and should then be placed in a bowl of cold water, until next required. A good plan to follow in hot weather is to place the feeding bottles once a day in a saucepanful of cold water (in which a tablespoonful of carbonate of soda has been dissolved) and to allow the liquid to slowly come to the boil. Afterwards they should be washed in cold clean running water. It is of equal importance that the teat should be carefully cleansed; the inside of the teat requires washing as well as the outside.

CHAPTER VI.

ARTIFICIAL FEEDING FROM FIRST WEEK TO TENTH MONTH.

The proper food for hand-reared infants is fresh cow's milk simply modified with Mellin's Food. This produces a liquid which is thin like mother's milk. Do not add sugar or any substance to thicken the milk. Ayahs and even English nurses, as well as mothers, are usually desirous of making the infant's food as thick as possible, with the object of making it more satisfying. A thick food may at the time appear to have such an effect, but in reality it produces torpor of body and endangers the life of the child. Until the teeth have appeared no food which will thicken with milk or hot water should be given to an infant.

How to Prepare Mellin's Food for use. The quantity of Mellin's Food directed in the following pages for infants of different ages should be mixed with a little water, which has been previously boiled, then allowed to cool. The remainder of the water and milk should then be added and the whole heated to a temperature of about 100 degrees Fahrenheit. **The mixture must not be boiled.** For fixing the temperature, and general nursery purposes, Mellin's Nursery Thermometer will be found very useful.

The Quantity of Food required by an Infant is most conveniently spoken of in terms either of fluid ounces or of tablespoonfuls. Twenty fluid ounces make a pint (one fluid ounce equals about two tablespoonfuls); an ordinary sherry glass contains about two fluid ounces.

During the First Week, the food should be prepared as follows:—

Mellin's Food	$\frac{1}{2}$ teaspoonful.
Cow's milk	$\frac{3}{4}$ tablespoonful.
Water which has been boiled	$2\frac{1}{4}$ tablespoonfuls.

Two to three tablespoonfuls of this food should be given every two hours during the daytime, and the same quantity twice during the night.

During the Second Week of life, continuous night feeding should be dispensed with.

Mellin's Food	$\frac{1}{2}$ teaspoonful.
Cow's milk	1 tablespoonful.
Water which has been boiled	$2\frac{1}{2}$ tablespoonfuls.

The amount to be given at a meal is three to four tablespoonfuls; average number of meals, nine during the day, two at night; interval between meals, about two hours. The child should, however, not be awakened to be fed.

Although precision in amount and punctuality in time should be carefully aimed at in the feeding of infants, yet they need not be rigidly adhered to—slight differences in the demand of the baby will occur from day to day, and these must be met by slight variations in the amount of food and in the mode of feeding.

As the child grows older, modifications should be slowly made in the mixing of the Mellin's Food for use, the milk and water being gradually increased, so that when the child is about **four weeks** old the following mixture would suit in average cases:—

Mellin's Food	$\frac{3}{4}$ teaspoonful.
Cow's milk	$1\frac{1}{2}$ tablespoonfuls.
Water which has been boiled	$3\frac{1}{2}$ tablespoonfuls.

This quantity will be sufficient for one meal.

As the child grows older, the Mellin's Food and milk should be still further gradually increased and the water decreased, until the child is **six weeks** old, when the following proportions may be used :—

Mellin's Food	1	teaspoonful.
Cow's milk	2	tablespoonfuls.
Water which has been boiled	4	tablespoonfuls.

The amount to be given at a meal should now be about six tablespoonfuls, and the average number of meals, seven during day, one at night; the interval between meals, about two hours.

For a child aged **two months,** use :—

Mellin's Food	1	full teaspoonful.
Cow's milk	$2\frac{1}{2}$	tablespoonfuls.
Water which has been boiled	$4\frac{3}{4}$	tablespoonfuls.

This is the amount necessary in average cases for one meal, and it should be given every two and a-half hours.

Again gradually increase the Mellin's Food and milk until at **three months** the following mixture is used :—

Mellin's Food	2	teaspoonfuls.
Cow's milk	4	tablespoonfuls.
Water which has been boiled	4	tablespoonfuls.

Give from six to eight tablespoonfuls of this mixture every two and a-half hours.

Increase the Mellin's Food and milk gradually as before, until the child is **four months old,** when the following proportions will be adapted for average cases :—

Mellin's Food	$2\frac{1}{2}$	teaspoonfuls.
Cow's milk	5	tablespoonfuls.
Water which has been boiled	4	tablespoonfuls.

Amount to be given at a meal, eight to nine tablespoonfuls ; average number of meals, six during day ; interval between meals, about three hours.

For a child aged **five months,** use :—

Mellin's Food	$3\frac{1}{3}$	teaspoonfuls.
Cow's Milk	$5\frac{3}{4}$	tablespoonfuls.
Water which has been boiled	$4\frac{1}{4}$	tablespoonfuls.

Nine to ten tablespoonfuls of the Mellin's Food so prepared to be given about every two and a-half hours, from 6 a.m. to 10 p.m.

At the age of **six months** the child's food should be prepared as follows :—

Mellin's Food	$3\frac{1}{3}$ teaspoonfuls.
Cow's Milk	$7\frac{1}{2}$ tablespoonfuls.
Water which has been boiled	$2\frac{1}{2}$ tablespoonfuls.

Amount to be given at a meal, from ten to twelve tablespoonfuls of the prepared Mellin's Food about every three hours, from 6 a.m. to 10 p.m.

When to Mix the Food for each Meal. In all cases where the climatic conditions are such that milk will not retain its freshness for more than a short time it is better to mix the food freshly for each meal. The proportions suggested above may be taken as suitable in all average cases, but just as infants of the same age differ in vigour and growth so they vary also in their food requirements, and this should be constantly kept in mind and slight modification made to meet particular cases.

Indications for Increased Quantity of Mellin's Food. Promiscuous advice is constantly poured out to young mothers, and they are unfortunately only too often ready to follow any new notion which an irresponsible chatterer may venture, so that the babe has not a fair chance. Every mother should remember, therefore, that where the infant thrives on the above diet she would do well not to interfere with the food. If, however, the infant appears dissatisfied and cries almost immediately after feeding, and exhibits constant restlessness, these symptons may be taken as indications either of the insufficiency of the food, or that it is not rich enough in character. Should these conditions arise, do not change the artificial food, but merely increase the quantity of Mellin's Food used in preparing the mixture until the baby is satisfied by its bottle, and becomes contended and happy.

Importance of Variation in Diet. As the child grows, and the demands made by the various organs of the body for nutritive material become greater, the quantities of Mellin's Food and milk used must be gradually increased so as to meet the requirements of the rapidly developing body. It must, however, be continually kept in mind that a proportion of Mellin's Food sufficient to ensure the thorough digestion of the milk must at all times be used. With all infants it is best to increase the Food very gradually. Abrupt variations are very likely to derange the organs of digestion, and such should be guarded against by care in preparing the food.

Changes in Diet to be Gradual. The quantity of Mellin's Food to be mixed with milk in order to produce a diet well adapted for children at different ages is a matter of considerable importance. It is difficult—in fact, practically impossible—to give rules which would be applicable in all cases for the preparation of the meal with Mellin's Food, or to prescribe the exact quantity to be given for a meal, since some infants are healthy, strong, and constitutionally perfect, while others are ailing, weak, and without stamina. It is therefore incumbent on mothers and nurses to use discretion in preparing the Mellin's Food. By a little patient experiment, the suitable proportions of the dry powder, milk, and water, the right quantity for a meal, and the proper temperature for each individual case may soon be determined; but, as before stated, it is necessary that an amount of Mellin's Food sufficient to ensure the digestion of the milk should be used.

Remove the Feeding Bottle after the Meal. The first sign of indifference, it may be remembered, is a sure indication that the infant has had enough, and the bottle should be at once removed from its sight, and not given to it again until the next meal.

The Frequency with which Infants are to be fed is a question equal in importance to that of the

quality of the food to be given. Care must always be taken that the meals are not too frequent, or too large in quantity. *Young mothers are often inclined to overfeed their infants.*

The Size of an Infant's Stomach. The average capacity of an infant's stomach is:

At Birth	...	$1\frac{1}{4}$	fluid ounces	$2\frac{1}{2}$	tablespoonfuls.
Second Week		$1\frac{1}{2}$	,,	3	,,
First Month		2	,,	4	,,
Fourth	,,	5	,,	10	,,
Sixth	,,	$6\frac{1}{2}$	,,	13	,,

It must be remembered that if an infant's stomach be constantly overloaded, even with a digestible diet, the effect is almost as injurious as if the child were fed upon less digestible food in more reasonable quantities.

Suggested Times for Feeding Baby.

First Week	Second to Fourth Week.	Second Month.	Third and Fourth Month.	Fifth Month.	Sixth to Ninth Month.	Tenth Month.
A.M.	A.M.	A.M.	A.M.	A.M.	A.M.	A.M.
6.0	6.0	6.30	6.30	7.0	7.0	7.0
8.0	8.0	8.30	9.0	9.30	10.0	10.0
10.0	10.0	10.30	11.30	12.0	P.M.	P.M.
12.0	12.0	P.M.	P.M.	P.M.	1.0	1.0
P.M.	P.M.	12.30	2.0	2.30	4.0	4.0
2.0	2.0	2.30	4.30	5.0	7.0	7.30
4.0	4.0	4.30	7.0	7.30	10.0	
6.0	6.0	7.0	9.30	10.0		
8.0	8.30	10.0	11.0			
10.0	10.0	A.M.				
A.M.	A.M.	2.30				
2.0	2.30					

It is a great mistake to accustom a child to take food whenever it cries. When a baby is hungry it must be fed, but all cries are not from hunger, and a mother should learn to distinguish them, and should remember that a little crying does good, while frequent feeding may do harm. Some cries are from thirst, and in such cases a teaspoonful of cold boiled water should be given.

Variation in Mixing Mellin's Food. In the rearing of infants by hand from birth slight difficulties frequently occur from time to time, when the food may appear to disagree. Perhaps at one time the child may develop a looseness of the bowels, while at another the motions may become unduly hard and the bowels sluggish in action.

Importance of Lime-Water in Case of Looseness of the Bowels. In cases where there is any tendency to diarrhœa lime-water (*see page 139*) should be employed in place of a portion of the water advised in the general directions upon the preceding pages. At first for very young infants a teaspoonful of lime-water may be substituted for one of ordinary water, and if the symptoms do not pass off then the quantity may be increased until half the water advised is replaced by lime-water. The modification to be made in the diet in severe cases of diarrhœa will be dealt with in Chap. XIII.

For persons who are travelling or those who find any difficulty in obtaining lime-water—which is an invaluable agent to have at hand when one has a baby to feed artificially—the saccharinated solution of lime* mentioned on page 140 is to be strongly recommended. It is much less bulky to carry, and when properly prepared will retain its activity for a long period. About 5 to 15, or even 20 drops may be mixed with each meal as the child varies in age from one month to ten months.

The use of Barley-Water in Constipation. When the motions become irregular and the bowels sluggish, then the best plan is to increase the quantity of Mellin's Food, or for a time decrease the amount of milk used in preparing the diet. In bad cases barley-water (*see page 140*) may be used instead of ordinary water for mixing the food. In many cases relief may be obtained and regularity and healthy action re-established by the use of a teaspoonful of ripe orange juice

* May be obtained of any chemist.

once or twice a day. This may be given to the child from a spoon, and if any difficulty is experienced in getting the child to take it this may be overcome by mixing a little of the Mellin's Food powder with the orange juice.

Mellin's Lacto. Where difficulties exist in obtaining regular supplies of good fresh milk, and in cases where the milk does not agree with the infant, Mellin's Lacto should be used. This food is prepared from rich fresh cow's milk and Mellin's Food, evaporated and reduced to a dry powder. Lacto possesses the following advantages :—

1. It is never sour, and is constant in chemical composition and physical properties.
2. The meal for the baby may be prepared with the greatest ease, for Lacto requires no cooking, but has merely to be mixed with warm water.
3. Another great advantage which is highly appreciated by mothers in India is that it secures constancy of character of diet, when moving from place to place.

For an Infant about One Month Old.

Lacto ... Two heaping teaspoonfuls.
Hot water... Five tablespoonfuls.

The amount given must be reduced for an infant under one month. As the child grows older the proportion of Lacto should be gradually increased.

For an Infant about Three Months Old.

Lacto ... One tablespoonful.
Hot water... Eight tablespoonfuls.

Increase gradually the proportion of Lacto used until the child is about six months old.

For an Infant about Six Months Old.

Lacto ... Two tablespoonfuls.
Hot water... Half a pint (20 tablespoonfuls).

For Invalids and Nursing Mothers. A somewhat stronger solution should be made in warm water to suit the taste.

Method of Preparation of Mellin's Lacto. Place the powder to be used in a large cup. Add a little hot, but not boiling water, and stir the whole into a thin smooth paste; then pour on the rest of the hot water directed, with constant stirring. The mixture is now ready for use. No sugar or other material is required.

For Adults. Milk may be added to the mixture of Mellin's Lacto when prepared as above, or it may be flavoured with tea, coffee, or cocoa, to meet the taste and idiosyncrasies of the user.

The Cause of Posseting. A baby often sucks its food very vigorously, and thus rapidly takes in more than sufficient to fill its little stomach; consequently it frequent returns the excess by what is known as "posseting"—that is, from time to time a small quantity of food slowly trickles from the corners of the mouth. When this condition arises it is necessary that the baby should be kept quiet after feeding. Indeed, most children are systematically overfed, for it is difficult for an inexperienced mother to realize how small is a child's stomach.

When the Diet Disagrees. Where a child is fed upon Mellin's Food, prepared as directed, and it in any case seems to disagree, the mother or nurse should endeavour at once to satisfy herself whether the fault be with the milk, with the method of preparation of the food or the way in which it is given. And it is well to bear in mind that the whole cause of trouble may be in the kind or condition of the feeding bottle employed. If an infant's digestive organs are for a time so out of order that milk cannot be retained, then Mellin's Food dissolved in cold water only should be used for a few days; it is usually best to give it in small quantities frequently repeated. In some cases Mellin's Food dissolved in barley water has given excellent results. As soon as the stomach gains tone a small quantity of milk should be cautiously added.

Feeding in Cases of Vomiting. In cases of acute vomiting, attended with more or less effort and retching, some errors in diet are indicated. The causes usually fall under the heads—

1. Too frequent feeding;
2. The use of improper artificial foods, containing starchy substances;
3. The use of cow's or buffalo's milk rich in curd, or too rich in cream.

With breast-fed children vomiting is due in most cases to the breast being given too frequently, or to some derangement in the health of the mother. The period between meals should be lengthened, and the mother's health should be attended to. Where infants are fed artificially, farinaceous foods should be discarded, and the milk employed should be subjected to examination. Should the vomiting become persistent, medical aid must be obtained. In any case all starchy foods must be abandoned, and Mellin's Food, prepared as directed, should be substituted and employed until medical advice is obtained.

It very rarely happens that the digestive powers of an infant remain quite normal during the whole of the first year, and consequently slight modifications are required in mixing the food from time to time to meet the peculiarities of the child.

Infantile Diarrhœa. Diarrhœa is one of the most serious ailments that a baby can have, and unless it is of a very mild character and the child only slightly out of health, the medical attendant should be sent for.

Suggestions for the modification of the diet in cases of diarrhœa and constipation are given in the chapter upon Minor Ailments (*page 71*).

CHAPTER VII.

INFANT FEEDING DURING AND AFTER WEANING.

FROM THE AGE OF TEN MONTHS TO TWO YEARS.

The Weaning of Breast-reared Infants. Where an infant is breast-reared, a period sooner or later arrives when it must be weaned. This time is determined by a variety of causes which it would be quite beyond the scope of this little work to discuss. Often before the usual time for weaning, the mother is suffering from the demands upon her system, and the breast-milk is poor and deficient; then the child should be alternately nursed at the breast and fed with prepared Mellin's Food.

Warning to the Mother. A most important point to notice in reference to the mother is that she will most probably suffer from persistent headaches when the child's suckling is too much for her.

The Proper Time for Weaning. No age can be definitely fixed which would apply in all cases, but if an infant is steadily gaining in weight, and if other conditions are also favourable, it should be nursed until about ten months old and should then be weaned. If possible the weaning should not be carried out in hot weather, or while the child is distressed by cutting its teeth, or during an illness, even if only slight. When

it is decided to wean a breast-fed infant, it should be fed at first with milk modified with Mellin's Food in the proportions of two heaping tablespoonfuls of Mellin's Food dissolved in twelve tablespoonfuls of water and then mixed with twenty tablespoonfuls of good fresh milk. The quantity of milk may be gradually increased to thirty tablespoonfuls and the water decreased to two tablespoonfuls. It is best to begin by substituting the prepared Mellin's Food for one nursing, and then for two, and then to alternate with breast feeding, and so on until weaning is completed ; this takes from four to six weeks.

When the Feeding Bottle is Refused. Occasionally a breast-fed infant will not readily take food from a bottle ; in such cases the breast must be refused it entirely, when hunger will usually compel it to take the bottle. The difficulty may usually be overcome by dipping the teat in dry Mellin's Food or honey.

The Introduction of Solid Food. The infant being weaned, or a year old if it has been bottle-fed, it should have one meal a day of semi-solid food, and very gradually, starch-containing foods may be introduced into the daily dietary. Perhaps the two best forms in which to begin the introduction of starchy materials in a condition easy of digestion are Mellin's Food Biscuits and Oat Jelly. The diet during all of the second year, however, must still consist largely of milk modified with Mellin's Food—one-and-a-half or two pints a day—which should now be given from a cup or spoon instead of a bottle. It is best to begin the use of solid food at the mid-day meal, and for this purpose a lightly boiled egg and a little bread and butter, with a tablespoonful of pudding, will be found very useful. All the more readily digestible forms of puddings, including those named in a later chapter, may be used.

Importance of Gradual Changes in Diet. If this is well borne, a further advance can soon be made

by adding a thin slice of bread and butter or a rusk or a Mellin's Food Biscuit to the second meal; these should be broken into small pieces and the child taught to chew them thoroughly. When an infant has become quite accustomed to these changes in the diet, the first meal should be increased by the addition of a slice of bread or a rusk broken up and soaked in the prepared Mellin's Food. Afterwards the fourth meal may be made like the first. If the child is thriving a fifth meal need not be given.

The Weaning of Bottle-fed Infants. Weaning from the bottle should always be commenced by the thirteenth month, and by the age of fifteen months the child should take liquid food freely from a cup, except the night feed at about 10 p.m., which for convenience may still be given by means of a bottle.

The Importance of Fruits in Infancy. The more easily digested portions of ripe fruits, such as the pulp of stewed prunes or of baked apples, may be given in moderation with the midday meal. At this period of life the fresh juice of a sweet orange is an especially serviceable addition to a child's dietary. When the infant is a year old, two or three teaspoonfuls may be given an hour before the midday meal and increased gradually to three or four tablespoonfuls.

Careful Attention Necessary. Between the ages of one and two years, the developing infant is gradually becoming prepared to take and make use of ordinary articles of diet, and, as each child is a law unto itself, very careful attention must now be given to the effects of different foods upon the child. Any error in the feeding, with respect to either quantity or quality, will be quickly followed by a more or less serious derangement of digestion with consequent impairment of the child's vitality. An indication that the food disagrees with the child will be afforded by a change in the character of the stools. Should they become greenish

in colour and accompanied by offensive diarrhœa, the food and method of feeding should be at once changed.

When Meats should be given. Between eighteen and twenty-four months of age, the child will have cut its first set of double teeth and it may have small quantities of the white meat of chicken or roast beef, beef-steak, roast mutton or mutton chop. This should be finely minced or scraped and mixed with bread crumbs or mashed potatoes and moistened with some natural meat juice gravy which has exuded from the cut meat. For weakly young children, underdone, finely shredded butcher's meat is to be recommended.

The Diet in Infancy should be Varied but Plain. Although there should be some variation in the food, care must be taken that this is not too great, for invariably infants thrive best upon a simple diet.

Foods to be Avoided. The following are some of the common articles of diet which are to be avoided in feeding infants and young children. Hard-boiled eggs, cheese, meats put up in tins, pork, salt beef, duck, goose, ham, lean bacon, heart, liver and kidney, and all highly seasoned dishes or rich gravies and soups. Dried fish, fresh-water fish, crustaceans (such as shrimps, crabs, lobsters), and all soft-bodied water animals, such as oysters, etc., are also to be avoided.

Heavy, close or new bread, pastry, sweet and rich cakes, currants and raisins in puddings, nuts, beans, pickles, radishes, cucumber, dahl, celery, parched grains or any vegetables which are indigestible for adults must not be given.

Drinks to be Avoided. Young children should on no account be given tea or coffee, and no alcoholic stimulants should be given, except under explicit medical orders. In cases of indigestion, gin and other spirits should not be given. A little hot peppermint or ginger water may, however, be used.

SUGGESTIONS FOR DAILY DIETARY AFTER WEANING.

TWELVE TO FIFTEEN MONTHS OF AGE.

First meal about 6 a.m.

About one-half pint of prepared Mellin's Food.

Second meal, about 8.30 to 9 a.m.

About one-half pint of prepared Mellin's Food and a thin slice of bread and butter.

Third meal, 1 to 1.30 p.m.

About one-half pint of milk and egg with Mellin's Food (or a lightly boiled egg with a little bread and butter), and a good tablespoonful of sago or tapioca pudding.

Fourth meal, 4.30 to 5 p.m.

About one-half pint of prepared Mellin's Food with a slice of stale bread broken and soaked in it.

Fifth meal, about 7 p.m.

About one-half pint of prepared Mellin's Food.

FIFTEEN TO EIGHTEEN MONTHS OF AGE.

First meal, about 6 a.m.

Three-fourths pint of prepared Mellin's Food in which a slice of stale bread or a rusk has been soaked.

Second meal, 9 a.m.

One-half pint of milk and egg with Mellin's Food and a slice of bread and butter or a rusk.

Third meal, about 1.30 p.m.

A cupful of meat broth with a little rice; a thin slice of bread and butter and a tablespoonful of rice or custard pudding.

Fourth meal, about 4.30 to 5 p.m.

Bread and milk with Mellin's Food.

Fifth meal, about 7 p.m., if needed.

One-half pint of prepared Mellin's Food.

EIGHTEEN TO TWENTY MONTHS OF AGE.

First meal, about 6.30 *a.m.*

One-half pint of Mellin's Food, and a lightly boiled egg with bread and butter.

Second meal, about 9.30 *a.m.*

One-half pint of Mellin's Food and Mellin's Food Biscuits.

Third meal, about 1.30 *p.m.*

One-half pint of beef, mutton or chicken broth or a lightly boiled egg with a thin slice of bread and butter; and milk and Mellin's Food, with a rusk or Mellin's Food Biscuits, saucer of rice or custard pudding.

Fourth meal, about 6.30 *p.m.*

One-half pint of Mellin's Food and a thin slice of bread and butter or a rusk.

TWENTY TO TWENTY-FOUR MONTHS OF AGE.

First meal, about 6.30 *a.m.*

One-half pint of Mellin's Food and a lightly boiled egg with bread and butter.

Second meal, about 9.30 *a.m.*

One-half pint of Mellin's Food and Mellin's Food Biscuits.

Third meal, about 1.30 *p.m.*

A good tablespoonful of scraped chicken, beef or mutton, with one well-mashed baked potato moistened with two or three tablespoonfuls of dish gravy. A little mashed peas or beans may also be given.

Fourth meal, about 6.30 *p.m.*

One-half pint of Mellin's Food and a thin slice of bread and butter, or a saucer of rice or tapioca pudding.

The milk used in preparing Mellin's Food should be raw milk of good quality.

A list of simple Foods and Drinks adapted for young children will be found upon pages 121 *to* 138.

CHAPTER VIII.

THE CLOTHING OF INFANTS.

The Clothing of an Infant very materially influences its condition of health, and may very largely determine its ultimate constitution; for it must be remembered that constitution, or the degree of health enjoyed by any individual, is not only partly inherited but largely acquired; consequently no subject of nursery hygiene requires greater care in India and the tropics generally than that of clothing. Babies are far more susceptible to changes of temperature than adults. Their liability to bodily derangements, in consequence of undue exposure, is far greater than in adults.

The Climatic Conditions vary so very much over the enormous tracts of country comprised under the term India that it is impossible to formulate rules which would be applicable in all parts of the country, but a few simple facts for general guidance may be stated.

The three properties to be considered in selecting the materials for a baby's clothing are:—1st, **softness**; 2nd, **lightness**; 3rd, **protection.**

A Baby's Skin is very soft and tender and readily chafed, which makes it necessary that care should be taken to choose those materials for its clothes which will not cause irritation. The clothing should be as light in weight as is compatible with due protection, and should be evenly distributed over the child's body. The sleeves of the dress should be made long and the

neck high. The arms, legs, and neck should not be exposed under the mistaken notion that such treatment will make the child hardy. For small children these precautions are very necessary in India, on account of the carelessness of ayahs.

The Area of India is so great that it necessarily embraces a variety of climates, and the following remarks must only be taken as embodying broad principles, to be varied in detail with local experience. It is first necessary to warn mothers on the one hand against the evils which may arise from a want of protection from the direct action of the sun, and on the other from the influence of night chills and dry winds. The tendency of young mothers is to load the chest of the baby with too great an amount of clothing, frequently neglecting the necessary protection of other parts.

All Clothing should be made Loose, and if a child be prematurely born, or constitutionally delicate, special care should be devoted to its underclothing.

Influence of Change of Temperature. Residence in India, and in tropical countries generally, tends to induce slight delicacies of constitution which render one more susceptible to diseases of all kinds, and this influence is most marked in early infancy. Nurses sometimes object to wrapping up children in India; but the dangers which arise from undue exposure are often greater than in England. The temperature falls so suddenly that the differences of temperature in the tropics before and after sunset are much more marked and rapid than in temperate climates. A chill, which in England would merely lead to a slight cold without serious consequences, will, on the other hand, in India frequently lead to the development of more dangerous symptoms. For this reason exposure to draughts and night air and **chills should be very carefully avoided.** It is well that young Anglo-Indian mothers should remember that a fall of a few degrees of

temperature in the tropics will make a much greater impression upon the highly susceptible body of an infant than a fall of many degrees in a temperate zone. There is probably no climate that requires so much attention to change of dress as that of India, and therefore a careful mother will vary her child's costume during the day with the marked changes of temperature.

The Baby's First Clothes are usually made very long, which practice is both unnecessary and uncomfortable for the child. For the first dress a length of twenty-six to twenty-eight inches is enough, measured from the neck to the hem of the skirt.

The best means of obtaining warmth in conjunction with softness without undue weight, is by employing lightly made woollen materials, such as fine, but not too closely woven, flannel, flannel-gauze, cashmere, and merino. Such fabrics cost little more than cotton or linen in the first place, and are much more durable. By doing away with the foolish and costly process of short-coating, a child may be provided at once with an outfit for its whole infancy.

The Washing of Woollen Materials is a somewhat troublesome question where one has to rely upon native servants. A mother should see that the *dhobee* adopts the following plan:—The water in which the flannels are put should be warm, *not hot*, and the lather should be prepared beforehand with some good soap—extract—or pieces of ordinary soap may be cut up small, boiled down with a little water in an old saucepan, and then added to the water in which the clothes are to be washed. Another plan is to add about a tablespoonful of fluid ammonia to each two gallons of water used for washing, by which means it is softened. The clothes should then be lightly and quickly rubbed, either with the hands or upon a washing board, until they are quite clean, rinsed in clear warm water, mangled, and allowed to dry quickly.

The number and shape of the various articles of clothing and the materials of which they are made will, of course, vary with the circumstances of the parents.

The Usual Outfit for a Newborn Baby:

6 shirts;
3 day flannels;
3 night flannels;
6 day dresses;
6 night dresses;
3 flannel binders;
3 dozen diapers;
2 head flannels—1 night, 1 day;
4 pairs wool boots;
1 soft fleecy wool shawl;
1 flannel and 1 mackintosh apron for washing the baby on; 2 or 3 dozen goodries.

Later, some bibs and flannel pilches will be required.

The usual cotton binders, which are often drawn round the child's body as tightly as possible and then stitched, not only make the child uncomfortable, but seriously impede its breathing.

The Shirt should be twenty-four inches round, and nine and a quarter deep. It may be made of fine nainsook or embroidery cambric, trimmed with narrow Valenciennes lace, of which one yard and a half will make six shirts; but a better material to use is fine merino vesting, or quite the best plan is to make them of **fine knitted Shetland Wool.** The latter plan, of course, necessitates a great deal of labour; but during the later stages of pregnancy absolute rest is necessary, and a young mother will find pleasure and relief in the work. Shirts are sometimes made with a small V gore let in under the arm; but this is quite unnecessary, and the seams prove a source of irritation to the delicate skin of the child.

The Binder should be of flannel, five inches broad, and long enough to pass twice round the child's body. It should be prepared without hems or turnings, and left with raw edges, and should be fastened with flaps taped at each side to tie across, and the use of pins avoided. When so made and used the binder is elastic, and serves as an efficient support for the abdomen without pressure upon any of the internal organs.

The Skirt and Bodice should be made of Saxony flannel, and it is preferable that it should be made in two parts, so that, should the lower portion become soiled, it may easily be removed without disturbing the rest of the clothing. The bodice should be about the same size as the skirt, save that it must be made to fasten down the front, and the skirt should be about eighteen inches deep when finished. The two portions should be fastened together by means of flat buttons on the bodice, and holes to correspond on the skirt. Some of these garments, for night wear, might be made in one piece.

The Dress should be made in one piece from neck to feet, and cannot be too simple, as comfort is essential. Twenty-eight inches will be found long enough from neck to hem, and fifty-two inches round the bottom. The sleeve should be cut in one piece, and the extreme length is ten-and-a-half inches, nearly three inches of which folds up at the wrists to form a cuff. It should be cut sloping up, so as to be introduced into the neck, by which means the armhole is made larger than usual, and so much easier for the introduction of the arm. The back of the dress should be open from neck to bottom, and the top gathered into a neck-band through which a draw-string should be passed to run round the neck. The front should be gathered about six inches from the neck across the body, and attached to about six inches of the centre of the band. The band itself should be made so as to fit *quite loosely* when brought round the waist. The material employed may either be fine nainsook, cambric, or flannel gauze.

The Night Dress may be of long-cloth, trimmed with narrow embroidery or lace, and cut the same shape as that for the day dresses. As soon as the band and night flannel are given up, the child should wear a fine knitted wool vest and a flannel nightdress. In the hotter parts of India, and during the summer in the plains, the best plan is to employ one made of fine

gauze flannel, and during the winter and in the hill districts thicker flannel must be used.

Boots are hardly needed where the clothing is purposely arranged to cover the feet; when, however, some kind of covering for the feet becomes necessary, those are best which are knitted of the finest wool.

Napkins should be made of some soft absorbent material, such as thin Turkish towelling. When soiled they should be removed as soon as possible, washed, and dried in the sun. Only one diaper should be used at a time; such a bulky lot of material as two or three diapers not only makes a child uncomfortable by pushing its thighs apart, but tends to alter the shape of its legs.

The Goodrie is a small quilted square, from fifteen to eighteen inches wide and twenty-four inches long, upon which it is the usual practice to carry infants in India. Half-a-dozen at least should be constantly in use, and they should be kept clean and dry, since they are constantly liable to soiling by the infant; they should be washed and dried daily by the ayah; weekly they should be sent to the dhobee to be thoroughly cleansed.

For Outdoor Purposes a white Chudda shawl, during the first months of life, serves well as an outer garment. Later a soft thin woollen garment with very loose sleeves should be worn. So long as a child is unable to wear a sun topee, it ought only to be taken out in the early morning or during the late afternoon, after five o'clock in most parts of India. The child should be carried about as little as possible to prevent friction of the arm and undue heating.

CHAPTER IX.

THE NURSERY AND AYAH.

We have considered in the preceding chapters the questions of feeding and clothing as being the two most important factors determining the health and well-being of infants. Before passing to the consideration of the minor ailments of childhood we may next refer to the possible influence of the nursery and nursing upon the health of the child.

The Nursery. In the choice of a room for a nursery the following conditions should be complied with. The room selected should be large, well ventilated, free from draughts, and not in the neighbourhood of a cesspool, closet, or any other source of unhealthy exhalations. An impure atmosphere tends to lower the tone of health, and not only induces a sickly constitution in the child, but, by reducing the vitality, causes a susceptibility to diseases.

Healthy Site for Dwelling. The rooms of Indian bungalows are usually large and airy, but the bungalows are not always themselves healthily situated. The following simple rules may be borne in mind by young parents when selecting the site for a bungalow :—

1. The site should be dry. Avoid, as you would death, a damp locality. In a town ascertain whether or not the proposed site is on "made soil."

2. The site should be elevated on rising ground, hillside or slope, never in a hollow. The hillside is usually warmer and drier.

3. The site should not be close to a swamp, slow river, milldam, or land which is overflowed a portion of the year, nor in such a place that the prevailing winds will bring to the house damp air and miasmatic vapours.

4. In a village or town build on as large a compound as possible, thus securing air and sunlight. Build back from the highway, thus avoiding the dust of the dry season and the curious gaze of every passer. Secure a site in which trees and plants will furnish shade and add to the general healthiness of the site.

5. In the country build the bungalow back from the highway, giving an abundance of room for trees and shrubbery about the house. Do not select a place where your family will be isolated from all social intercourse, so necessary to the health of mind and body.

6. For the aspect let the house be so placed that it will receive fresh air. Avoid, even if offered rent free, a damp, dark house with no chance of the free air to sweep through it. The living-rooms should always be warmed by the morning sun. If the cold winds from the north and west are severe in winter in hill districts, they may be broken by a cluster of evergreen trees planted on those sides.

7. The bungalow should always be built so that the ground flour is raised a few steps above the level of the earth. And if one part is raised to a greater extent than the rest in consequence of the slope of the soil, a room on the higher side should be selected for the nursery.

The Nursery and all the surroundings should be bright, clean, and cheerful; no unnecessary furniture, rugs, curtains, or hangings should be allowed. Although flowers may be permitted in the daytime to beautify the room, they should be removed at night, for the stagnant water and the aroma given off by the plants do not add to the purity of the atmosphere. And the one essential in the matter of air is that it should be pure and, as nearly as possible, of a uniform temperature. In the matter of wall covering, wood varnished or painted, or distempered or painted walls, are best. These may be adorned with pretty prints from the home illustrated papers.

A Cot should be provided, with a fairly firm horsehair or grass mattress, protected by a macintosh sheet, and on no account should the baby be permitted to sleep with the nurse.

The Cot should be placed near one side of the room in such a position as to escape direct draught. Near the inner wall is preferable, but do not place the bed so that it is exposed to the strong rays of the morning sun, for although sunlight is good, and possesses many hygienic properties, yet the strong glare disturbs the rest and acts injuriously upon the eyesight. It is best to shelter the side of the bed most exposed to air currents by means of a screen. Good ventilation should be secured, but means must be taken to prevent draughts. At night, during the rainy season, the outer shutters should be closed, and in districts of India where the punkah has to be employed at night care must be taken that it is not so violently pulled as to produce draughts of cold night air.

The Night Clothes of the Baby. Children, especially when young, are very apt to be restless during sleep, and to throw off the clothes. A very good plan, therefore, is to make the bed gown long and close it at the bottom, by means of a running tape. By such a

garment, even where the bed-clothes are thrown off, the body is protected from draughts. And this is of the utmost importance since it is to the chills to which babies are exposed during the sleeping period that much of the delicacy and sickness of Anglo-Indian children may be traced. These precautions with respect to the night clothes should receive the greatest attention during the period of the monsoons.

Importance of Supervision. For the best conditions to be secured it is absolutely necessary that a mother should herself superintend the nursery, and see that the directions which she lays down for the management of her child and its surroundings are followed in every detail. With even the best native servants a mother has to combat against ignorance, prejudice, and carelessness, and she can only hope to obtain the best conditions for her babe by personal supervision of details. The young Anglo-Indian mother must be prepared to sacrifice a great deal of her time to the care of the nursery and her children if she would have them brought up under the most healthy and favourable conditions. Of course, where a mother has the advantages of a good English nurse a great deal of the responsibility and anxiety is taken from her; but where she has to depend entirely upon native servants, she will, as a rule, find that it is necessary to exercise constant vigilance, and to superintend the treatment of her babe and the general work of the nursery, in order to secure that the rules which she lays down shall be readily adhered to.

Sleep. A newly born infant sleeps the greater portion of the day, and usually, when healthy, wakes up only for feeding. The amount of sleep required decreases as the age and activity of the child increases, until at the age of one year a child will sleep some fifteen or sixteen hours out of the twenty-four. Some young children suffer from excessive activity of brain, and are

restless, and sleep but little at night. Ayahs are much disposed to administer soothing drugs containing opium or morphia; a mother should therefore guard against this, and should not allow the ayah to administer drugs or medicines of any kind whatever to her child. Nor should she employ any of the so-called soothing syrups herself, but where such conditions arise in a child as are referred to above she should call in medical aid.

The symptoms of drugging, for which a mother should carefully watch if she has reason to suspect that the child's sleep is not quite natural, are as follows:—

Heavy Sleep. The child if roused dozes off again immediately. Remember that a child under four months will usually not sleep for longer periods than four hours to four hours and a-half at a stretch.

The breathing during sleep is irregular, and at times scarcely perceptible.

The child on waking is not anxious for food.

The pupils of the eyes become contracted.

The face usually becomes pale during sleep.

Where drugs are employed in small quantities in a short time the digestion is interfered with, the appetite is reduced, constipation is produced, the excreta becomes hard and clay-coloured, and these symptoms are usually followed by pallor, feebleness, and general wasting.

Sleeplessness is frequently due to want of fresh air and exercise, or to error in diet, unless, of course, it may be traced to teething troubles, or to the existence of internal worms. A child should be taken into the open air as much as possible. At three months a child should be taken out twice a day at least; in the morning say at 6.30 in summer, and 7 in winter, and after 5 in the afternoon. But a young babe cannot, as a rule, be kept out with safety for more than three hours during the day in any part of India.

Until the child reaches the age of one year he should be allowed to sleep at any time, and it is a great mistake to rouse a child, at this early age, from healthy, natural sleep.

Crying. Infants cry more often from indigestion caused by improper feeding or over-feeding than from hunger, and although they may be pacified for a time by giving the breast or bottle, they soon cry worse than before. There are many other causes which give rise to fits of crying, such as thirst, fright, and in India, especially, the irritation produced by the strong light. Sudden outbursts of crying may be due to discomfort arising from tightness or wetness of underclothing, pins, fleas, mosquitoes, or other insects.

Crying due to indigestion and griping is loud, often accompanied by vomiting or discharge of wind, and the infant writhes and draws up its little legs, whilst the cry from inflammation in the chest is short and stifled, because pain is caused by the movements of the chest. It is, therefore, important to carefully notice the nature of the cry of the infant, for such furnishes an indication of how relief may best be given.

CHAPTER X.

CARE OF THE CHILD.

Next to a good English nurse ranks, as a rule, the East Indian nurses, and where such have been brought up and trained in European schools they make much better servants than ordinary ayahs. Nevertheless, the ayah is the nurse found in most Anglo-Indian homes, and it may not be out of place here to lay down a few rules for the guidance of mothers in directing her duties.

When the Babe wakes in the Morning about 5.30 to 6 o'clock the first duty of the ayah is to "hold him out," and the next, when he is old enough, to give him his bath, after which he must have his first bottle of Mellin's Food, which must be prepared in accordance with the directions. If during the night he has perspired freely, the whole skin should be carefully rubbed with a soft towel before bathing, care being taken to avoid draughts. The skin of a baby is very delicate and is much more susceptible to changes of temperature than that of an adult. The child, should, therefore, be rapidly sponged with water at about 90°F.

The soap used should be of good quality. It should not be artificially coloured or perfumed; the colouring and odorous matters so largely employed in preparing toilet soaps are only too frequently the means adopted to mask inferior materials employed in their preparation. These added substances never increase the value of a soap ...ch, and, on the other hand, they act as irritants to delicate skins. After the bath the skin should be carefully dried with a soft towel, and some good dusting powder should be dabbed into the folds of the arm-pits,

groins, and buttocks with a soft puff. Where the infant is given two baths a day it is not necessary to soap the whole of the body, and at all times the ayah should be sparing with the use of soap, but not with the towel.

Attention should be paid to the finger and toe-nails. They should be cut straight across and not down at the sides, or an ingrowing nail may result.

Care of the Ears. Care and attention must be given to the ears of the new-born baby. They will be small and well set, or coarse and protruding, in after life, according to the care which they receive from birth until the child is six or seven years old. Never under any condition allow them to become crumpled while the infant is asleep, and if they show a marked tendency to protrude, a soft muslin cap should be tied on during the night. As the child grows older, if the ears still show an inclination to stand out from the head, a good plan is to softly massage them and press them backward at the same time using the nightcap.

Care of the Scalp. While the child is very young the head should be washed daily, little soap being used, but when the hair becomes so long that there is a danger of chill after washing then once a week the child's hair and scalp should be shampooed.

Before taking the Child out the ayah should open all windows, and put the mattress, bedclothes, and mackintosh to air, and place the empty food bottle and teat in filtered water, containing a pinch of borax, to soak. The baby should, in most parts of India, be ready to go out at 6.30 or 7 o'clock.

The mother should prepare a second bottle of food for the child's return, about 8 or 8.30, or, where a second ayah is kept, of course this duty would devolve upon her.

The Feeding Bottle. For successful hand-feeding it is of paramount importance that the food should be given in a proper manner, and, therefore, care must be taken to select a suitable feeding bottle. The shape

must be such that the bottle can be quickly, easily, and thoroughly cleaned. For this reason a Mellin's Feeding Bottle should be used, for it not only fulfils the above conditions but is stronger and consequently more durable even when roughly used, and it is graduated to show the actual quantities to be given to children of different ages.

After each meal the feeding bottle and the nipple should be at once washed and thoroughly brushed out and then kept in cold water to which a little borax has been added until next required. Young mothers will find it better to have two bottles in use, one of which should be in soak while the other is in use. Both the bottle and nipple must be kept scrupulously clean. To the disregard of this precaution may be traced many cases of diarrhœa and even more serious illness.

The following rules must be attended to in the case of hand-fed children :—

1. The feeding bottle should be taken away as soon as the contents are finished.
2. If the child refuses to empty the feeding bottle it should be taken away at once. There is a constant tendency on the part of ayahs and inexperienced mothers to overfeed infants, and this error the young mother should carefully guard against.
3. If any food remains in the bottle at the end of the meal it should be thrown away, and on no account be warmed up for the next meal.

On the return of the Ayah from the early morning walk about 8 or 8.30 a.m., the child should be "held out" and then fed.

After Breakfast the baby should be "held out" again, or placed on the "stool" until the bowels are moved. Restlessness may be prevented by toys or picture-books, when the baby is old enough to be interested in such things.

The Morning Sleep. At 11 or 12 o'clock the infant should be completely undressed and placed in a darkened room for midday sleep for from two to three hours. The morning sleep should be kept up in all cases where possible until the child is at least four years old, and it may even be continued with advantage until the age of five years. On waking the child should be dressed and fed again about 1 or 1.30. The next meal should be given about 4.30 to 5. The child, if old enough, may then be dressed for going out, and taken out for an hour.

At 7 o'clock the evening meal should be given before the child is put to bed. Many young Anglo-Indian mothers make the mistake of supposing that children must be put to bed as early in India as in England, forgetful of the fact that if a child sleeps for two or three hours during the heat of the day it does not require the same amount of sleep at night. In most parts of India a child cannot go out in the afternoon until after 5 o'clock, and as its age increases it becomes more and more necessary that it should stay out as long as possible, usually until about 6.30 or 7 o'clock. Of course, the hours will vary somewhat in different stations, but these simple rules hold good over vast areas in India.

When the child is put to rest, care must be taken that the blankets, mattresses, sheets, etc., are clean, sweet, and perfectly dry. A good plan adopted by many experienced Anglo-Indian mothers is to place the child on a mattress upon the floor. The great advantage of this plan is that the infant may be placed with ease in any part of the house to secure coolness. The infant should always when sleeping **be protected from mosquitoes** by a light mosquito net. The best forms are shaped somewhat like a dish cover, and are made of light cane and gauze. By this means the necessary protection is provided and ventilation not unduly interfered with.

Importance of Fresh Air and Exercise. The young infant requires fresh air and exercise. In most parts of India a baby may usually be sent out carefully clothed after it is two weeks old. The ayah should not be allowed to sit about and gossip, but she should walk about with the baby because the motion thus imparted to its body gives the necessary exercise. When in the house, even while awake, the young baby should be carried in the arms, frequently changing position, as gentle movements are necessary for the health of the internal organs and bodily development.

Use of the Nostrils. Infants should be trained as early as possible to make proper use of the nose for breathing. They should be taught to breathe as much as possible with closed mouth.

When the child is out it is necessary that he should be sheltered from the direct sun heat, and as soon as he is old enough a sun topee should be worn. A mother should know exactly where an ayah takes her children, and should see that the directions which she gives on this subject are followed in detail.

The ayah should not be permitted to give native sweetmeats to the children in her charge. The mother should insist on great personal cleanliness on the part of the ayah. She should be made to take a daily bath, and to wear clean clothes.

Importance of Regular Habits. It is of the greatest importance that regularity should be observed in the management of infants. The routine of the day should proceed like clockwork. The result will be that gradually the child will acquire habits of regularity. Its meals and bath must be given at exactly the same time every day. It should be put to bed at the same time every morning and evening. It should be put on its chair at the same times every day. It is possible to train a child to use its chair at regular intervals at a very early age, and the inculcation of regularity in this

respect has an important bearing upon its after health and well-being. By the time it is nine or ten months old it will, if properly trained, in all ordinary cases have learned to wait to be put on its chair and not wet its diapers. The two chief causes of ill-health during early childhood are constipation and diarrhœa. The former condition frequently arises from the inability of the child to properly digest the food, and it is sometimes caused by carelessness on the part of the nurse in inducing regular habits.

Learning to Walk. When the child is first learning to walk great care should be taken to guard against its standing on its feet for too long a time, and it should not be allowed to get tired walking. If left to itself it will stand for a while, and when tired will sit down or crawl about. For this reason it should not be encouraged or urged to stand or walk; but its spontaneous efforts should merely be watched and guided. Knock-knees or bow legs, frequently result from much standing and walking before the legs are strong. When it is out of doors vary its amusement by giving it a ride in its carriage part of the time, letting it walk only for short intervals. Do not urge it or even permit it to lift heavy things, such as would tend to tax its strength.

When a child is walking and holding on to an older person's hand, the child's arm should not be stretched to its full length. The grown person should see that the child's hand is no higher than its shoulder—even a little lower is better. It must be allowed to use the leader's hand as a support, and must not be pulled along, but should be permitted to go as fast or as slowly as it likes.

A young child should not be lifted by the arms. The hands should be placed upon its body one on each side just below the armpits and it may then be raised gently but firmly. The ayah should carry the child on her right and left arm alternately.

CHAPTER XI.

TEETHING.

Care during Teething. The teething period is usually a trying time for both the mother and child in India, and the complications which arise during teething sometimes lead to serious ailments. Not that the ailments which so frequently accompany teething should be considered as caused by this perfectly natural process of development, but as rather consequent upon the unstable condition of the physical economy at this stage of life. This is a period of great activity in the growth and development of a child, and the balance of health is frequently upset by comparatively minor causes, which at other times under more stable conditions of body would produce little or no ill effect. It is this unbalanced condition which causes the extreme susceptibility to ailments at the teething period, and in tropical climates the very greatest care is required in the management of the infant. In fact, under ordinary conditions of management this must be regarded as the most critical period in the baby's life.

The age at which a Child cuts the first Tooth varies in individual cases; the majority of children, however, begin to cut their teeth when from four to six months of age. Some very vigorous and forward children may begin as early as three months, and with those of weakly constitution teething may be delayed until the eleventh or even twelfth month. Teething seems to be less painful and more rapid in India than in England; but the attendant disturbances of health and accompanying ailments need greater care and attention.

During teething, in ordinary cases, the child grows irritable, refuses food at the regular times, and becomes feverish at night, and an inexperienced young mother may imagine that the baby is about to be very ill ; as a rule, directly the teeth appear, these symptoms pass off.

At the age of two and a-half years a child, as a rule, has his first complete set of teeth ; these are known as the **twenty milk teeth.** These teeth are usually cut in the following order in each jaw :—

2 Central Incisors, or Front Cutting Teeth ...	6th month.
2 Lateral Incisors, or Outside Cutting Teeth ...	9th ,,
2 First Molars, or Lateral Grinders	12th ,,
2 Canine, Dog, or Eye Teeth	18th ,,
2 Second Molars, or Posterior Grinders ...	24th ,,

Of these the teeth in the lower jaw make their appearance first, and the corresponding teeth in the upper jaw soon follow the development of those below. The teeth which give the greatest trouble to the child are the second molars, which are usually cut about the end of the second year.

The second set, or **permanent teeth,** begin to make their appearance about the sixth year.

First molars	5th to 7th year.
Central incisors	7th to 8th ,,
Lateral incisors	8th to 9th ,,
First bicuspids	9th to 10th ,,
Second bicuspids	10th to 11th ,,
Canines	11th to 12th ,,
Second molars	12th to 13th ,,
Third molars	17th to 21st ,,

While a child is teething several symptoms occur, none of which need necessarily be dangerous, but if neglected they may lead to serious after-results.

For some few weeks before the appearance of any teeth the child dribbles at the mouth, the eyes water, it suffers from thirst, diarrhœa, cough, and often from fever. Where the teeth come in rapid succession the

symptoms are often more severe, attended by convulsions, inveterate vomiting, squinting, ear-ache, and various forms of skin rashes.

Many of these symptoms are merely the result of the nervous irritation set up during the teething period, and unless they are severe, medical aid is unnecessary.

Dribbling during teething is a good sign, and as a rule the less painful and irritating the cutting of teeth to the child, the more marked the dribbling becomes.

Increased attention should be devoted to the supply of fresh air and exercise, warm baths at night should be given, the head must be keep clean and cool, and attention should be directed to the diet in order to secure that the child has an abundance of proper food. These simple hygienic measures go a long way towards making dentition painless for the child, and reducing the anxiety of the mother.

Should the child suffer from sickness after feeding, the milk should be diluted with lime-water, or a pinch of bicarbonate of potash may be added to each bottle.

The action of the bowels should be attended to, and regular normal excretion should be maintained by occasional doses of fluid magnesia. In cases of cough during teething, a teaspoonful of glycerine should be given two or three times a day. Sometimes tooth cough is attended by marked constipation ; in such cases doses of castor-oil emulsion should be given *(see pp. 73-74)*.

Convulsive symptoms should be immediately carefully attended to, for infantile convulsions not infrequently lay the foundation of abnormal nervous conditions, which may lead to epilepsy in after life. Cooling, mildly aperient medicines should be given, and if the symptoms do not disappear, medical aid must be sought.

When a fit of convulsions comes on, the head should be sponged with cold water, and the child should be placed bodily in a bath of warm water at about blood

heat—viz. 98° Fahrenheit. After removal from the bath the child must be wiped with a soft towel and placed in warm blankets, care being taken to keep the head cool.

Where dentition is painful and the gums become swollen and inflamed, the child will shrink or cry when the gums are touched with the finger, and in such cases it is advisable to obtain medical advice as soon as possible, and if thought necessary to have the gums lanced. When dentition is normal, the gentle friction of the gums with the finger is soothing to the child.

It is of the utmost importance that during teething the mother should exercise watchful control of the ayah, who should be strictly cautioned against giving to the child any drug or soothing syrup. The use of opium and mixtures containing opium and Indian hemp is frequently resorted to, and a mother should carefully guard against their use in any form, save, of course, under medical advice.

It is very important that the regular development of the teeth be watched and that the aid of the dentist be sought at an early period in order to correct any irregularities. From quite an early period the teeth should be brushed every day with a small soft tooth brush ; once a week they should be cleaned with any mild tooth powder or wash.

CHAPTER XII.

VACCINATION.

Vaccination is the operation by which an infant or adult is inoculated with a material which is produced in cow-pox. The disease known as cow-pox is a peculiar complaint which affects the teats of cows, and in the early history of vaccination it was noticed that those persons who were in the habit of milking cows so affected secured immunity from ordinary small-pox. These observations led Jenner to the idea of introducing beneath the human skin some of the fluid produced in the eruptions present in cow-pox, with the object of affording protection against small-pox. It was found that the two diseases, cow-pox and human small-pox, were antagonistic to each other; that the vaccinia of the former, introduced beneath the skin, produced such changes in the body as to sterilise the blood against the human disease, small-pox. It appears that **the efficiency of the vaccination** does not in all cases remain throughout life, but by re-vaccination complete immunity from the loathsome disease may be secured. Even in cases where a vaccinated person does take small-pox the disease runs usually a comparatively mild and simple course. In England, and in European countries generally, the disease is so under control that one rarely meets a person marked by small-pox. But in India, and the East generally, where vaccination is by no means universal, there is a high death rate from

this complaint, and it will be observed what a large percentage of the natives are deeply scarred and pitted by the disease.

The Liability to infection from small-pox is therefore far greater in India than in England, in consequence of its prevalence among the native races, including the Hindoos of all castes. Every Anglo-Indian mother, therefore, should seek at the proper time protection for her child from this vile disease. The actual operation of vaccination is a simple one, and if the usual precautions are taken by the operator, and cleanliness and care exercised by the ayah and mother, no ill effects should arise. Nevertheless, slight disturbances are produced in the health of the child, which may temporarily cause the mother some anxiety at this period.

The time at which vaccination may best be performed will vary under different circumstances, but in all ordinary cases the operation should be performed **between the ages of six weeks and three months.** In India, however, where the child is healthy, it is advisable to have the operation performed as early as possible, save that it is best to avoid the rainy season of the year, or the period of the monsoon, for at this time complications are more likely to arise.

When the operation has been performed no special care is required, save the precaution that the inoculated part shall be kept scrupulously free from external causes of irritation. Rubbing, scratching, and dirt must be carefully avoided. For the first eight days after vaccination the part should need only the ordinary shield against scratching. About two days after the operation the punctures made will become somewhat swollen and hard; on the fifth day a small circular vesicle, with raised edges and a depressed centre, is seen. By the eighth day this vesicle becomes distended with a clear fluid, and is either pearl-coloured or somewhat

yellow. From the eighth to the tenth day a small inflamed ring makes its appearance round the base of the vesicle, and this extends for some two or three inches round the central spot. About the tenth day, if all goes well, the swelling begins to disappear, and the little vesicle turns brown and becomes scaly, forming a scab which drops off about the twenty-first day, leaving a permanent discoidal scar. If the operation does not follow this course, especially if the vesicle appears earlier than the fifth day and the inflamed ring is not present, the vaccination must be repeated.

Treatment of the Child after Vaccination.—The most important precaution is to keep the arm free from all likely causes of irritation. The dress sleeve should be loosened. This is best done by opening the seams of the sleeves of the dresses to be used, and sewing in tapes, which may be employed to fix the sleeve as loosely as desired.

A dusting powder prepared from equal parts of oxide of zinc and boracic acid will be found most useful in subduing the heat of the spots.

Where the irritation is more marked, and medical advice is not at hand, relief may be afforded by loosely binding up the part with pieces of old soft linen, which are kept moist by dipping them in a solution of borax in filtered water. Where the spots become very much inflamed and the child evidently suffers considerable pain, hot fomentation may be applied. But unless it is absolutely necessary to resort to this mode of relief, moist applications should be carefully avoided, as they only tend to soften the heads of the vesicles and prevent them from drying.

Source of Vaccination Material. This is a matter about which many young mothers in India give themselves unnecessary anxiety. In European countries calf vaccine lymph is almost always employed for the vaccination of children, and in England its use has become quite

general; in India, however, although it is increasingly employed, difficulties exist in obtaining fresh supplies. In Bombay and other large cities vaccination is generally performed direct from the calf. Outside the large cities of India the origin of vaccination material usually resolves itself into the question of white child or native. A mother should understand that vaccination is just as efficient from a healthy native child as from a white one. The question of healthiness is one for the medical man, and a mother, having selected with care her medical adviser, must trust to his knowledge and skill. Remember that it is against the interests of any medical practitioner to vaccinate from, or recommend vaccination from, a child whom he knows to be unhealthy. All that a mother can do is to learn as far as possible the antecedents of the child from whom it is proposed to vaccinate her infant, and ascertain that the medical man is informed of the same.

In the preceding lines we have dealt with the objects and methods of vaccination of Anglo-Indian children; but while an Anglo-Indian mother, as a rule, understands something of the advantages of this preventative measure, the same is not true of the bulk of the natives. In spite of the good hygienic work which has been done by the Zenana Missions, and the improvements in sanitary education brought about by the National Indian Association, progress is but slow, and much remains to be done to educate the masses in the advantages of the simplest matters of hygiene.

CHAPTER XIII.

MINOR AILMENTS.

Diarrhœa is one of the most serious of the minor ailments of infancy in hot climates, and unless it is of a very mild character and the child only slightly out of health, the medical attendant should be sent for. In India, Burma, and Ceylon it must be regarded as the most dangerous form of illness which a baby can contract.

Common Causes of Diarrhœa. The causes of diarrhœa are varied, and consequently the symptoms to which they give rise differ somewhat in detail.

Firstly, simple Diarrhœa is generally brought about by unsuitable food.

Where the baby is breast fed, then attention should be directed at once to the mother's health.

If the child is being hand-reared, as so frequently becomes necessary in India, in the large majority of cases it will be found that the distressing symptoms arise from one of three causes—

(*a*) The use of farinaceous food.

(*b*) Some peculiarity of the milk employed.

(*c*) The use of a bad form of feeding bottle.

A healthy baby for the first six months should have two to three motions in twenty-four hours. Any greater number than this indicates a tendency to diarrhœa. The excreta should be of a golden yellow colour and nearly devoid of odour, or at most, only slightly faint.

If the baby does not refuse food, or otherwise seem unwell, it would not be advisable to check the activity of the digestive organs. Should the motions become more frequent, being passed immediately after food is taken, and if they are watery, slimy, or greenish in appearance, then it is pretty certain that something is seriously wrong. An effort should be made to discover the causes which give rise to these conditions.

Importance of Change of Diet in all cases of Diarrhœa. Where the child is hand-reared and a farinaceous food of any kind is in use, it should at once be abandoned and Mellin's Food prepared and employed as directed on page 30 should be substituted. If the child is already being reared upon a diet of Mellin's Food, and symptoms of diarrhœa make their appearance, in mild cases it will be necessary to reduce the quantity of milk in mixing the Mellin's Food and to substitute lime water for from one-third to one-half of the water indicated in the general directions given.

Goat's milk should be avoided, and the cow's or buffalo's milk, if used, should be examined, and if found to be curdy in nature, then lime water must be employed to dilute the milk in mixing the food.

Since diarrhœa troubles are very frequently associated with the condition of the milk employed, it is advisable in such cases to change the source of supply at once. The water, too, employed in mixing the food is sometimes responsible for the symptoms, and only water which has been previously well boiled is permissible for this purpose. Water which has been filtered alone must not be relied upon, for there is no form of filter which can be depended upon to yield satisfactory results in the hands of native servants.

If a bottle provided with a tube has been in use, it should at once be discarded and a Mellin's Feeding Bottle should be substituted.

In more acute cases where the infant cannot retain milk, no hope of relief can be entertained until this is excluded from the diet. In such cases Mellin's Food should be prepared with water alone by dissolving a tablespoonful in half-a-pint of hot water, or barley water may be substituted for ordinary water. The addition of a tablespoonful of lime water to the mixture, prepared with barley water, has proved very valuable in some cases of simple diarrhœa. As thus prepared, the Mellin's Food may be given cold ; and in cases where the vomiting or purging is severe, a teaspoonful only should be given at a time, repeating it at intervals of ten minutes. When the vomiting and purging have been arrested, the child may be allowed to suck slowly from the feeding bottle. After a couple of days have elapsed without the return of the symptoms, a little milk may be cautiously added to the diet ; this should be very gradually increased as the child's stomach gains vigour. In a case of diarrhœa the child may seem to be hungry when, in reality, he is thirsty, and food being given the stomach under such circumstances is overtaxed and the complaint is aggravated. Cold water which has been boiled may be freely given.

A Second Form of Diarrhœa commonly seen in infants is marked by the rapid passage of the food through the stomach and bowels, from which it is excreted often apparently unchanged, in curd-like masses. The infant suffering from this form of diarrhœa usually has frequent attacks of sickness, and suffers from violent griping pains. This condition is usually set up by the irritation caused by improper food or by exposure to cold night air, and is most likely to arise from this cause in the hill stations of India. In the early stages a very small dose of castor-oil, given in the form of an emulsion, is very helpful.

The emulsion may be prepared by mixing three drachms each of gum arabic and loaf sugar to which

two drops of oil of peppermint and six drachms of water should be added. The whole must be thoroughly rubbed up in a mortar with the gradual addition of one ounce of castor oil and sufficient water to make the whole up to four ounces. The emulsion must be well shaken before use, and one half to one teaspoonful should be given every four to six hours. It may be obtained of any chemist.

The Third or Inflammatory form of Diarrhœa is the most dangerous, for in this condition more or less acute inflammatory changes of the coats of the stomach and bowels are set up. The object of the mother should be to establish safeguards against this complaint by the study and practice of hygienic conditions. The questions of treatment and cure are beyond the scope of this little work, but it may be pointed out that preventative measures lie chiefly in the direction of attention to diet and clothing.

To guard against Diarrhœa. Infantile diarrhœa in the tropics, like the summer diarrhœa which proves so fatal to infants at home, must be looked upon as a complaint which needs immediate attention, in consequence of its extremely dangerous nature.

The disease is essentially preventable, and as explained above, it is often closely associated with a want of care in the selection of the food or in the preparation of it, or it has its origin in the uncleanliness of the apparatus used in the preparation of the food, or the improper form of feeding-bottle employed.

The following notes on summer diarrhœa in infants were recently published in the *British Medical Journal*, and although the whole of the advice is not perhaps applicable to the Anglo-Indian mother, yet so much of what is stated applies not only during the summer in temperate zones, but at all times in the tropics that this valuable information is reprinted at length.

"The prevalence of summer diarrhœa in infants and its high mortality are alike deplorable, and this the more so as it is in a large measure a preventable disease. Any measures, then, which can be devised for its prevention are deserving of commendation, and the step taken by the authorities of the Paddington Green Children's Hospital in issuing the following card of instructions to mothers is one that might be followed with advantage by other bodies:

"'**Summer Diarrhœa in Infants.** Hundreds of infants die during the summer from diarrhœa and sickness, which may, with proper care, be prevented, but cannot always be cured. If mothers will read carefully and carry out the following instructions, they may hope to save their infants from dying of these complaints.

"'**I. Breast-fed Babies.** Diarrhœa and sickness are much more common in bottle-fed than in breast-fed babies, therefore mothers should always suckle their infants when possible for eight or nine months.

"'But infants should *not* be weaned during the hot weather.

"'**To Prevent Diarrhœa in Breast-fed Babies.** Suckle the baby regularly, *not* every time it cries.

"'Give the baby *nothing* but the breast milk and water to drink.

"'Wash the mother's breasts and nipples before and after suckling.

"'Wash the inside of the Baby's mouth with a clean wet rag after nursing.

On no Account Give Babies Fruit, Ice-cream, Fried Fish, or Bits from their Mother's Plate.

"'To strengthen herself, the mother should take milk and plain food, *not* beer or stout or spirits.

"'Nursing mothers should avoid over-work and fatigue, and should remember that worrying or quarrelling may spoil their milk, and give the baby diarrhœa.

"'In summer any dirt entering the mouth may produce diarrhœa. Therefore, do not let babies suck dirty soothers, teats, comforters, or thumbs.

"'**II. Bottle-fed Babies.** Summer diarrhœa in infants is chiefly due to bad milk and dirty feeding-bottles and teats.

"'In hot weather milk quickly turns sour or becomes tainted by dust, dirt, and flies, and may easily bring on diarrhœa unless the following *precautions* are taken :

Buy the milk *twice* a day—not *once* only—and get the best cow's milk you can, as cheap milk is always dangerous.

Boil it at once for one or two minutes.

Then place it in a covered vessel in a basin of cold water and keep cool. The milk must be covered over to prevent dust and flies from reaching it.

Always taste the milk, in a spoon, before putting it into the bottle, to see that it has not turned sour. Do *not* put the teat in your own mouth at all.

Do *not* keep any milk in the bottle for the infant's next meal. Use it for youself or the rest of the family.

The bottle should be boat-shaped, with an india-rubber teat, but *no* long rubber tube.

The bottle should be scalded out after use, and cleaned with a bottle brush, which should be boiled immediately before using.

After each feed the nipple should be turned inside out and washed, and kept with the bottle in cold water.

Good milk is often spoiled by dirty bottles.

When fresh cow's milk cannot be obtained, or the milk has turned sour, use the best sweetened condensed milk.

Get small tins, as after the tin is opened the milk will soon go bad.

Cover an opened tin with clean muslin or butter cloth to protect it from dust and flies, and keep in a cool place.

In any case of sudden diarrhœa or vomiting stop the milk at once, give only plain water which has been boiled, or barley water, and take the baby to a doctor without delay.

Do *not* think that the diarrhœa will pass off, as the baby may be so ill in twenty-four hours that no treatment will be of any use.

Do *not* be afraid that the baby will starve if only plain water or barley water is given for a day or two. There is no danger of this.

Do *not* think when a baby cries or is sick that it only wants more food.

In hot weather do *not* keep bones, stale vegetables, or fruit and other rubbish for the dust bin, in the room or house. Burn as much of the rubbish as possible. Rubbish breeds flies, and flies poison the food they settle on.'

"The instructions seem admirably adapted for their purpose. More emphasis might, perhaps, have been laid on the fact that in summer infants, like adults, suffer from thirst, and that in many instances a few teaspoonfuls of cold water are more grateful to them than milk in any shape. In very hot weather it is advisable to diminish the amount of cow's milk given, either by a further dilution of the strength or a lessening of the quantity of each meal, and to make up the deficiency in fluid by the administration of cold water at intervals. Instead of sweetened condensed milk, we would have preferred a good brand of unsweetened, which, after opening, should be treated in the manner advised for the storing of cow's milk.

" It is open to question whether the paragraph about the safety of giving plain water or barley water for a day or two is advisable in a list of instructions to mothers; such treatment should only be carried out under the strictest medical supervision. The slight criticism we have ventured is, however, largely a matter of opinion, and in no way diminishes our appreciation of the instructions as a whole."

Dysentery not infrequently attacks quite young children. The symptoms which are most likely to make their appearance in the hot weather are fever, much looseness of the bowels with straining, the passage of viscid or slimy motions, charged with much mucus and, in the latter stages, blood; the griping is very marked, and the straining violent. The infant suffering from this condition rapidly loses flesh, becoming pale and exhausted. This disease takes but a few days to reduce even a robust and vigorous child to an emaciated condition. A warm bath is always soothing, and often does good, and in any case the child should be kept warm and sleep induced. A simple, but very useful remedy is white of egg beaten up in diluted milk or cooled boiled water; this is nourishing and somewhat binding in its action. Since this condition is attended with considerable danger, medical aid should be obtained as soon as possible.

Constipation is the condition in which the excreta become hard and changed in colour. Many young infants suffer from this ailment, yet few mothers treat the matter with the serious and immediate attention which it deserves. The conditions which create these distressing symptoms in infants may arise from various causes.

Firstly. When the child is breast-fed and constipation is set up, in most cases it will be found that the mother's health is out of order, and a little attention to

this matter will lead to the disappearance of the symptoms in the child. The remedial measures which the mother should adopt lie in the direction of more exercise, greater care as to diet with increased use of vegetable foods and fruits, and doses of Mellin's Fluid Magnesia.

Secondly. In the large majority of cases of hand-reared infants, a tendency to constipation makes its appearance during the first few weeks of life in consequence of the use of improper artificial foods. Farinaceous foods act as irritants to the bowels ; and where they are employed, constipation is frequently associated with short and intermittent attacks of very offensive diarrhœa. The child should in such a case at once be placed upon a diet of Mellin's Food, prepared and employed according to the age, when the symptoms will usually disappear.

Again, where an infant is being reared upon a diet of Mellin's Food prepared as directed on the preceding pages, constipation is sometimes caused by inability on the part of the child in certain cases to digest the milk. In such cases a larger proportion of Mellin's Food must be employed in preparing the bottle than that directed for average conditions. In some cases it is advisable to decrease the proportion of milk at the same time. Between the feedings cool boiled water should be given to the baby, and this should be used freely upon the first indication of constipation. Care should be taken to keep the feet and limbs warm.

It is a very bad plan to give strong purgatives to infants for constipation, for they tend to lower the healthy tone of the digestive canal. By slight variations in the proportion of the ingredients of the food it usually becomes possible to correct this distressing condition. Where such means fail, then gentle laxatives, in the form of mild salines, such as Mellin's Pure Fluid Magnesia, may be given with advantage.

Where the symptoms are very pronounced and persistent, an ordinary aperient may be used—Mellin's tasteless castor-oil is one of the best, given in doses of a half to two teaspoonfuls according to the age and condition of the child. Mellin's suppositories will induce easy evacuations without fatiguing the stomach.

Thirdly. Constipation is sometimes caused by chills. This form of sluggish activity of the bowels and liver is very common in India, and especially so amongst weakly children ; it is usually accompanied by loss of appetite and the passing of solid clay-coloured or pale motions. The best remedial measures are :—

(*a*) Change of diet. Mellin's Food prepared with twice the bulk of water advised in usual cases for a child of this particular age may be given.

(*b*) Hot fomentations over the belly and gentle rubbing.

(*c*) Warm clothing and protection from draughts.

Fourthly. Another form of infantile constipation which is extremely common arises from a want of muscular tone, or weakness of the muscular coats of the digestive canal. The employment of abdominal friction, coupled with a liberal diet of Mellin's Food, prepared as directed according to the age of the infant, will usually remove the symptoms.

Prevention of Constipation. Much may be done to cure constipation by care in inducing regular habits both in feeding and excretion. An infant should be fed at regular intervals and held out at the same time each day. A child's bowels for the first six months should be opened two to four or not more than five times in the twenty-four hours. The excreta should be neither hard nor very fluid, and they should be of a bright yellowish-brown colour. The quantity of urine passed by an infant is proportionately greater than that of an adult ; in appearance it should be clear and of a very pale straw colour, not turbid nor cloudy.

Watch the Infant's Motions. If the motions are very solid and cause pain, the abdomen should be rubbed with the hand, or with some oily substance, such as ordinary salad oil. The friction should begin at the right lower portion of the abdomen and pass upward and to the left down and back again in a somewhat elliptical fashion. It should be continued slowly, gently, but firmly for ten to fifteen minutes.

As the child grows older, two or three teaspoonfuls of plantain mashed up in milk, with a small quantity of Mellin's Food, given before breakfast will usually rectify any ordinary sluggishness or irregularity of this character. Another useful corrective, which may be given to quite young infants who may develop symptoms of constipation, is ripe orange juice from one to three or four teaspoonfuls per day, the first to be given on waking in the early morning.

Flatulence is closely connected with indigestion, and although quite without danger, it often causes the child considerable pain. The carelessness and ignorance of ayahs have much to answer for in this matter. They frequently allow babies to suck the teats of empty feeding bottles, and often bind their little charges too tightly, both of which causes tend to induce flatulence. When the symptoms are slight, the child should be laid on its belly or back, and gently but firmly rubbed; a warm bath, too, will in most cases relieve the symptoms. A change in the proportion of the Mellin's Food and milk, or change of milk supply alone, and attention to the points mentioned above, will usually be followed by the disappearance of the symptoms. Peppermint Cordial is very useful in cases of flatulence in infancy.

Griping is a frequent source of distressing symptoms in very young infants which cause the mother much anxiety. The symptoms are: violent screaming, without any apparent cause; the legs are drawn up; the motions become slimy and usually greenish in colour.

In the case of breast-fed children the cause of this griping is frequently to be found in some errors in the dietary of the mother. It cannot be too strongly urged that the diet of a nursing mother should be simple, abundant and nutritious, without great variations.

In the case of hand-reared infants carelessness on the part of the ayah in preparing the food—such as the use of sour milk, or of milk just upon the point of turning, or of a bottle which has been but imperfectly cleaned—is a frequent cause of stomach-ache, and such errors should be carefully guarded against.

A mother should never permit a part of a meal to be kept from one feeding time to the next, but the baby's bottle should be emptied at once at the end of the meal and thoroughly washed out and then placed in boiled water to soak. The smallest quantity of soured milk or food left in a bottle is enough to upset the baby, and in India milk will keep sweet but for a very short time. The greatest care should therefore be exercised to guard the babe against this serious danger. Where griping arises from over-feeding, the best remedy is a dose of castor-oil.

Protrusion of the bowel may be caused either by constipation or diarrhœa. The bowel comes down through the anus, forming a reddish swelling, which may be no larger than a small nutmeg, or quite as large as a pigeon's egg; it may bleed slightly, and causes in any case a great deal of pain. To return the bowel press up firmly by means of a sponge which has been wrung out in cold water. When the bowel has come down once it is always liable to do so again; care should therefore be exercised over the infant every time it has a motion. Efforts should be made to remove at once any tendency to constipation or diarrhœa. A cold sponge bath every morning will help to strengthen the child, and bathing the parts with cold water after the bowels have acted improves the muscular tone and serves as a preventative measure.

Thrush, also known as white mouth, is a peculiar form of inflammation of the lining membrane of the mouth, which frequently occurs in infants, more particularly in those reared by hand. The complaint is essentially preventable, and usually arises from a want of cleanliness. The signs of thrush are numerous, irregular, roundish white specks on the inner surfaces of the lips, gums, palate, and cheeks. Each little spot is surrounded by a deep reddish space, and is so tender as to cause great pain in swallowing, and the child experiences such difficulty in sucking that it refuses the breast or bottle. These symptoms are usually accompanied by a certain amount of redness and soreness between the legs.

The spots in thrush are really due to the growth of a minute vegetable fungus. The organism grows freely in milk which has undergone decomposition, and its development is probably promoted by a want of scrupulous cleanliness. The fungus will grow in the crevices of feeding-bottles and other utensils which have contained milk. The complaint is most likely to occur during the hot season.

Treatment. After a meal the child's mouth should be wiped out with warm water in which a pinch of carbonate of soda has been dissolved. The mouth should then be cleansed by means of a camel-hair brush or soft linen soaked in a mixture of borax and glycerine, or in Mellin's Glycoborate. When thrush has declared itself, all milk must be carefully boiled, and a few grains of carbonate of soda or carbonate of potash added to each meal. Where the symptoms are accompanied by vomiting, it may become necessary to substitute beef-tea or chicken-broth or barley water for milk. Absolute cleanliness must be enforced, and it is of the utmost importance that the feeding-bottle and teats should be thoroughly cleansed after use, and before each meal. Where the attack is persistent and the

condition of the child does not improve in two or three days, medical aid should be sought.

Croup. This disease is confined to young infants. The term is somewhat loosely employed by mothers and nurses to embrace a large group of symptoms occurring in young children. The symptoms which arise in croup are due to inflammatory changes which take place in the lining membrane of the windpipe. An attack of true croup usually begins like a common cold, with slight feverishness, hoarseness, drowsiness, and running at the eyes and nose. The best treatment is a hot bath, and to adopt every means to induce sickness by tickling the back of the throat with a small brush or feather, or by passing the finger into the back of the throat, or by the use of such simple emetics as salt water and mustard and water. Greater care should be exercised in the matter of food, times of feeding, and to the regular action of bowels. It is of very great importance that medical advice should be sought early, for prompt attention and careful treatment are very necessary. The disease is not infrequently followed by fatal results when neglected in its early stages.

What is known as "False Croup" usually begins at night, the child waking up and catching its breath, being apparently on the verge of choking. These symptoms are most likely to appear among badly-fed infants living in insanitary surroundings.

Child Crowing. These attacks are very similar in character to false croup, and are common during the teething period. An infant, apparently in perfect health, is seized with a spasm, and the breathing is for a time completely arrested. As the spasm passes off and respiration is renewed, the breath is drawn in with a crowing sound very like that produced in false croup. When an attack occurs, the child should be turned on its face. This plan will often cut short the spasm ; or a hot sponge on the throat, cold water dashed in the face,

and the free use of smelling salts must be resorted to. General preventative measures lie in the direction of improvement of the general health, exercise in the open air, wholesome easily digested food, and attention to the regular action of the bowels. A medical man should be consulted as soon as possible.

Infants in good Health have a soft smooth skin, clear eyes and red lips. The body is rounded and the bones well covered with flesh, but there is no excess of fat—the limbs feel firm, not flabby. The bowels of a healthy infant act at least once a day, the motions being soft, but not loose, and of a deep yellow colour. The greater part of its time is passed in quiet sleep. The weight steadily increases at the rate of at least a pound a month during the first year, and three-quarters of a pound a month the second year, so that at two years of age the weight should be about twenty-eight pounds. The gradual progressive increase in the weight is a good indication of health and normal development. Every infant should be weighed once a week, at the same time of day, during the first month, then every fortnight for three months, once in three weeks for the next three months, and once a month the rest of the first year, and every three months during the second year, when all is well, but more frequently if the child is ill, or appears out of sorts, or when the food seems to disagree. A small infant may be laid on a folded flannel or blanket and put on the pan of a pair of kitchen or shop scales—care must be taken to deduct the weight of the flannel or blanket, and if weighed in clothes to carefully weigh the clothes afterwards and deduct their weight.

Growing children should also be weighed regularly, and the weight of the clothes deducted, as recommended in the case of very young infants. Twice a year will be frequent enough if the child is in good health.

Infants and children generally gain weight more rapidly during the cold season; in the hot weather even healthy children may lose weight. The weight of an infant may be conveniently recorded upon the special "**Infants' Weight Chart**" issued by Mellin's Food Company for India, copies of which may be obtained free upon application to the Mellin's Food Agents in India, Burma, or Ceylon.

CHAPTER XIV.

INFLUENCE OF CLIMATE UPON ADULTS.

Importance of General Hygiene. The previous pages have been devoted to the consideration of some of the chief causes and methods of treatment of the minor ailments of children, but since the health of parents influences the health of their offspring, and the condition of the mother's health who is breast-feeding her babe largely influences the state of health of that babe, the enormous importance of the study of general hygiene in India must be apparent to the reader.

Dr. C. Theodore Williams, in a lecture recently delivered before the Sanitary Institute in London, says :—

"**The Effect of Great Heat on Different Organs of the Body** is as follows :—In the case of the lungs it reduces the number of respirations from 16, the standard in temperate climes, to 12·74 in the tropics,

accompanied by a slight spirometric increase, but not enough to account for the decreased number of respirations, and so the respiratory function is diminished 8·45 per cent. The water exhaled from the lungs is reduced, and the observations of Parkes and Francis show that the lungs of Europeans dying in India are lighter than the European standard after death, proving that these organs, being brought less into physiological activity, diminished in size.

"The heart's action does not appear to be materially quickened or the pulse rate increased in the tropics, but the powers of digestion are weakened, the appetite fails, and the liver becomes congested, and tends either to tissue induration or abscess. The urine is lessened in amount and the urea reduced, possibly from the smaller amount of animal food consumed. The skin acts freely, and its secretion is stated to increase 24 per cent. in the tropics. The nervous system is depressed, and sleep is not so sound as in temperate or cold climates.

"**Protracted Residence in Hot Countries** induces further deterioration in Europeans, impairing the functions of digestion, assimilation, and circulation, and hence the power of making healthy tissue; the tint of the skin and the colour of the conjunctivæ, also the expression of premature age, proclaim the length of a European's residence in the tropics. European children demonstrate most forcibly the unfavourable effects of hot climates, and in India it is generally thought desirable to bring them at an early age to a cold climate like that of this country to escape the effect of the tropical heat, and few sights are more pleasing than to see these puny, pallid, skinny, fretful little ones converted, by British food and British meteorology, into fat and happy English children.

"**Sunstroke.** The most obvious effect, however, of great heat is sunstroke, which occasionally occurs in

temperate as well as tropical climates, and though principally due to exposure to the solar rays, according to Sir Joseph Fayrer, happens frequently to people in houses, barracks, and tents, and not only when they are exposed to sunheat ; it may occur by night as well as by day. The subjects of a sunstroke are generally those debilitated by disordered health, dissipation, or over-fatigue.

"According to Fayrer, there are three varieties of sunstroke, each characterized by a certain group of symptoms :—

"*The first, showing itself in exhaustion and failure of the heart's action.*

"*The second is a condition of shock in which the nerve centres, and especially the respiratory nerve centre, become implicated, causing rapid failure of respiration and circulation ;*

"*The chief feature of the third is intense pyrexia, due to vaso-motor paralysis and to the nervous centres being over-stimulated, and then exhausted, by the action of heat on the body generally.*

"From the first form recovery is frequent, but the second is far more serious, and is generally due to the direct action of the sun's rays on the head and spine. The brain and nerve centres, including the respiratory nerve centre, are overwhelmed by the sudden rise of temperature, respiration and circulation fail, and the heart is found contracted after death. The symptoms of this form are generally those of violent injury to the nerve centres, unconsciousness, cold skin, feeble pulse, and death from rapid failure of respiration and circulation.

"The third form, the so-called 'heat fever,' is an intense state of feverishness, the effect of heat on the nerve centres, and through them on the vaso-motor system, resulting in the raising of the body temperature

to as high as 108° or 110° Fahr., or even higher, by heat—solar or artificial. This is the form which comes on at night or in the shade, if the temperature be high, and chiefly affects those exhausted by dissipation, fatigue, or overcrowding. Sir Joseph Fayrer teaches us that all the nerve centres suffer from over-stimulation, followed by exhaustion. Here is dyspnœa of a hurried, gasping kind, great restlessness, thirst, frequent micturition, and pungent heat of the skin, which is sometimes dry and sometimes moist. The pulse varies from full and laboured to quick and jerking ; the face, head, and neck are congested to lividity ; the pupils, at first contracted, may dilate before death. Delirious convulsions, often epileptiform, coma, relaxation of the sphincters, and suppression of urine precede the end, but not infrequently partial recovery takes place, to be followed later by relapse and death. The mortality from sunstroke is between 40 and 50 per cent., but of those who recover many are permanently injured, either in brain power or in general health ; and we find as a result impairment of memory, nervous irritability, headache, and even epilepsy, partial paraplegia, partial or complete blindness, and extreme intolerance of heat, and especially of the sun's rays.

"There are, however, cases of recovery from sunstroke, especially when contracted in temperate climates, which are either complete or present less serious lesions than the above. In fatal cases, after death, the lungs are found deeply congested, the heart firmly contracted, the venous system gorged, and the body marked by petechiæ. The blood is more fluid than usual, and acid in reaction ; the globules have less tendency than usual to form rouleaux, and are deficient in oxygen. The body, after death, for some time retains a high temperature, and the viscera, when first exposed, feel pungently hot, and when incised, drip dark blood. The brain and the membranes are intensely congested, and there are sometimes serious effusions into the ventricles or

hæmorrhages into the brain substance. The cause of death is generally asphyxia, but apoplexy is occasionally found."

Of the **Diseases Prevailing in Hot Climates,** and apparently dependent for such prevalence on the special conditions of those climates, it will be noted that dysentery, and its frequent companion, which is also not rarely its sequel, liver disease, form part of the group. A map of the geographical distribution of these diseases shows that liver disease is confined to hot countries, and does not largely overstep the limits of the tropics; whereas dysentery has a somewhat wide range, but prevails with far greater virulence in the tropics than in subtropical and temperate regions. Fayrer shows that at Calcutta the deaths from dysentery and diarrhœa amounted in one year to 1,516, and that the mortality from these causes was highest in January (243 deaths) and lowest in May (85 deaths).

Dysentery is often attributable to drinking impure water and to insanitary surroundings, as well as to malaria. Some cases appear to arise from sudden meteorological changes, such as from hot to cold and from dry to wet weather. All the causation of this disease seems to be largely governed by the influence of climate, and hence its greater prevalence in hot climates compared with cold.

Liver Disease in India was attributed by the late Professor Parkes to errors of diet on the part of Europeans in a hot country; and probably there is truth in this, but it can hardly account for the high mortality among Hindoos, Mahommedans, and natives generally from this cause.

With regard to the introduction of preventive measures among the native population, Surgeon-General Sir William Moore says: "Perhaps the greatest difficulties we have to contend with are found in the

internal social life of the people; for while there may be, and is, a certain amount of authoritative interference outside, it cannot be extended inside houses, or to the personal hygiene of the people.

CHAPTER XV.

WHAT TO DO IN EMERGENCIES.

In India, where the distances are often so great as to render it very difficult to obtain medical aid, it becomes important that nurses and mothers should know the course to be adopted in sudden emergencies, and accidents.

General Conduct in cases of Accident. In all cases of accident, the safety of the injured one depends largely upon the first steps taken by those around to afford relief. If from the following pages a mother learns how to act efficiently in such emergencies, she will have pleasing satisfaction in the knowledge which may enable her at any moment to soothe the suffering, alleviate the pain, and expedite the cure of her child, or to save the life of another.

It is necessary in all cases of accident to pay particular attention to the following points, in order that the treatment may be rewarded with the greatest success :—

1. Try to be collected, calm and decided ; and before adopting any mode of treatment make up your mind definitely as to what you intend to do. Having decided upon a course, carry out

your intentions calmly, firmly, and rapidly, paying no attention to modifications suggested by bystanders, which may cause delay and increase the sufferings of the injured one.

2. Lay the patient in a position which is the most comfortable—usually on the back, and so in a horizontal position ; but if a difficulty is experienced in breathing when so placed, then slightly raise the upper part of the body.
3. Loosen the clothes about the neck, chest, and waist.
4. If the body of the patient feels cold, cover it with blankets ; restore warmth by friction or other artificial means, unless the coldness is attended by copious bleeding.
5. Do not administer stimulants unless the patient is completely exhausted, or remains in a fainting condition for more than twenty minutes, and even then only give small quantities.

Treatment of small Cuts and Wounds which are not of sufficient importance to need the advice of a surgeon. Such injuries are often rendered very troublesome or even dangerous by unskilful treatment. Care should always be exercised, therefore, even in the treatment of slight cuts and simple wounds. The wound should be washed with a little warm water, if at hand, or cold water which has been boiled or filtered may be allowed freely to flow over it, the wound being afterwards wiped with clean linen. Such a mode of treatment secures the removal of dirt or foreign matter. The cut edges should then be pressed firmly together, and held in their places by strips of plaster placed at right angles to the cut.

Where cuts are more serious it becomes necessary to modify the mode of treatment, according to the kind of vessel from which the blood is escaping. The blood

flows in the body through **three kinds of blood vessels**—namely, **arteries, veins,** and the very minute vessels which connect the smaller arterial branches with the small veins—the **capillaries.** The arteries are usually more deeply seated than the veins; in fact, most of the blood vessels which can be seen through the skin with the naked eye are veins. The blood contained by these three classes of vessels varies in colour; that present in the arteries is bright red or scarlet, and that of the veins dark red, whilst that which is found in the capillaries is intermediate in colour.

The differences in the manner in which the blood leaves the vessels, as well as its colour, enable one to determine the source whence it comes. The blood which issues **from a wounded artery** is of a bright red colour, and spurts forth in jets corresponding to the beats of the heart, whilst that **from a wounded vein** is much darker in colour, and flows in a continuous stream. In bleeding from the capillaries the blood oozes from the wound.

Bleeding may generally be stopped by pressure properly applied. Remembering that the blood flows *along veins towards the heart,* and *along the arteries away from the heart,* it becomes necessary to explain how and where the pressure should be applied in the case of the two kinds of vessels. Where bleeding is **from a wounded vein,** if direct pressure will not stop the flow of blood, a ligature should be passed round the limb, and made to tightly press on the side of the cut **remote from the heart.**

The blood from an **injured artery** is jerked or spurts out chiefly from the side of the wound which is nearer to the heart. If direct pressure will not check the bleeding, a tight ligature must be passed round the limb, and be made to press especially on the portion which is **nearer to the heart.**

When bleeding is taking place from the external surface of the body from any cause, try—

Direct Pressure on the Part, and raise the limb above the level of the body. If the wound is in the leg, let the patient be placed on the back and the leg raised. The pressure may be produced by any soft substance, such as a handkerchief, sponge, cotton-wool, or even the fingers.

If the above means are not attended with the desired effect, but the bleeding remains unchecked by simple pressure, it is necessary to **pass a tourniquet or ligature round the limb** as tightly as possible *immediately above* the point from which the blood issues. A medical man should then be sent for, or the patient carefully removed to the hospital or to some place where surgical aid may be obtained. The ligature above alluded to may be made with a pocket-handkerchief, strips of cloth, rope, twine, or india-rubber cord.

In Cases of Scalp Wounds, pressure can be made on the wound itself by means of some soft substance, such as a handkerchief, cotton-wool, or a piece of lint. If a pad is made of such a substance, and held pressed tightly down by the fingers, it will in most cases at once arrest the bleeding.

Bleeding from the Face and Jaws may generally be arrested in the same manner—that is, by using a pad to press the wounded part down upon the hard bones which are beneath.

When the Bleeding is from a Diseased Surface—abscess, ulcer, or such like—and direct pressure does not check the flow of blood, the wound should be bandaged tightly with styptic wool, which may be prepared by soaking

good cotton-wool in a strong solution of alum or tincture of steel, and allowing it to dry gradually. If no styptic wool is at hand, then ordinary wool or linen rag soaked in cold water, and made into a pad, should be tied tightly round over the wound.

Varicose Veins are a condition of the blood vessels which is due to the giving way of the little valves which normally regulate the flow of blood in these vessels—the weight of the column of blood, being uncontrolled, causing the veins so diseased to become dilated. When a varicose vein in the leg has burst, the limb should be raised higher than the rest of the body, and a handkerchief or other bandage should be tied tightly below the wound.

In cases where **blood flows from the nose** as the result of injury to some of its blood-vessels, cold water or ice should be applied. Some persons are very subject to bleeding from the nose, by which means it not unfrequently happens that they lose a very considerable quantity of blood; in the case of growing children, and those suffering from debilitating diseases, this becomes a very serious matter, and means should at once be adopted to allay the flow of blood. In such cases the patient should be kept perfectly quiet on his or her back, cold being applied at the same time to the back of the neck, and a cold pad kept over the nose. If, however, such means fail to check the flow of blood, a piece of cotton-wool or styptic wool folded and tied to a piece of string should be introduced into the nose, and gently pressed upwards.

The Vomiting or Coughing up of Blood in considerable quantities are symptoms of grave importance, which are often present in ulceration

of the stomach and consumption in its many phases. In such cases the best plan is to keep the patient as quiet as possible; he should not be permitted to speak under any condition, but should be allowed to breathe fresh air freely, and ice or iced milk or water may be given. If the bleeding is very considerable, a cold wet towel may be applied to the chest, and if the blood flows from a broken vessel in the lungs, the patient should be allowed to inhale freely the vapour of turpentine mixed with steam. This may be prepared by mixing three tablespoonfuls of turpentine with about a quart of boiling water—the mixed steam and vapour given off by which may be inhaled by the patient.

In Cases of Bleeding, the patient frequently becomes weak and faint. This is not necessarily a dangerous or serious sign, for the faintness, which results in a quieted or reduced circulation, facilitates the staying of the bleeding, since, the rate of flow and pressure being reduced, the blood sooner coagulates and forms little plugs of clot, which naturally close the injured vessels and check the flow of blood. Of course, if the faint is prolonged and the bleeding does not diminish, it becomes necessary to adopt means to revive the patient.

Burns.—Burns are produced by flames and hot solid substances: they vary in severity according to the source of heat by which they are produced, and the length of time during which the injured part is exposed. They may vary in nature from a slight redness of the skin to complete charring and destruction of the skin and flesh.

Scalds are produced by hot fluids: those resulting from oil or milk are more severe, as a rule, than those produced by water. The danger which attends this class of injuries varies with the part and the extent of

the body involved; for example, even slight burns or scalds which involve a large surface are generally more serious than severe burns, which only affect a more limited area. Where the burn or scald is slight, and *there is no actual wound,* the part may be bathed with, or soaked in, a strong tepid solution of washing soda.

The means that may be taken to relieve the suffering in the case of this class of injuries are :—

Firstly, is to exclude the air as quickly as possible by **pouring over the injured part some linseed or sweet oil.**

Secondly, **carefully remove all clothing** in contact with the part. If this cannot be easily done, the garments should be freely cut, in order that the pain and suffering may not be increased unnecessarily by dragging the clothes over the injured part. The oil may be poured upon or between the clothes and the body, if the burn is severe, for the oil softens the cloth and facilitates the removal of the clothes, thereby reducing the chances of tearing away the skin.

Thirdly, **soak some cotton wool or lint** in linseed or pure sweet oil, and apply it to the injured part, renewing the application from time to time. Carron oil, which consists of equal parts of limewater and linseed oil, is one of the best remedies which can be utilised. The oil employed may be either linseed, olive, or almond oil—never any mineral oil, such as paraffin or naphtha.

Owing to the inflammable nature of clothing in India, especially that worn by women and young children, the catching fire of their garments is attended with the very greatest danger. In no case of accident is there greater need for presence of mind and coolness. Remember that air is necessary for combustion; therefore, if a person's clothes take fire, means should immediately be adopted to cut off the supply of air.

This object may be attained by enveloping the person in a cloak, rug, blanket, or similar article. People should remember that if a person on fire runs, the consequences will probably prove fatal; a person whose clothes catch fire should throw himself down and roll over and over. Remember that persons who have been scalded or burnt suffer much from shock, and need relief from this; after attention has first been paid to the injured parts, therefore, apply warm coverings and give warm stimulating drinks.

Treatment of Bites. *Bites* of animals with sharp teeth, such as cats, dogs, and fishes, may produce one or more punctured or incised wounds, or tear the flesh and produce a lacerated wound, or they may simply cause abrasions of the skin. The mode of treatment to be recommended will, of course, vary with the nature of the injury, but in all cases immediate antiseptic treatment is to be recommended, for an animal's mouth is so apt to contain septic matter. Where the pain is severe, hot fomentations or poultices are most soothing.

Hydrophobia. A great deal of misapprehension exists as to the danger incurred by the bites of dogs, and it therefore will not be out of place to remark that there is no fear that hydrophobia will ensue unless the dog is affected with the disease. The following notice with respect to the subject of hydrophobia has been issued by the Brown Institution:—

"This disease occurs in dogs of all ages, and may appear at any season of the year. It is recognised by a change of demeanour of the dog, which becomes dejected, morose, inclined to roam, and anxious to hide itself. The animal gnaws at wood, stones, or any refuse which it sees, snaps at imaginary objects, and becomes unusually excited by strange or sudden noises. It rubs its throat with its paws, as if striving to get rid of some object lodged there; at the same time there is a more or less abundant flow of saliva

from the mouth. The animal is, moreover, very readily excited, and barks with a peculiar, harsh, strange cough. The dog will attack its master or animals of any kind; but it is most easily roused to fury by the presence of other dogs. It is feared and shunned by healthy dogs—not only when it attacks them, but when the disease is in a very early stage. There is throughout the disease no dread of water. Before the tendency to bite shows itself the animal may be unusually affectionate to his master—licking his face and fawning upon him. In one form of the disease, called 'dumb madness,' there is a paralysis of the jaw, and therefore inability to bite. If a dog has shown any of the symptoms of madness mentioned above, or an unusual tendency to bite other animals, it should be at once loose-muzzled and securely chained up, but it is advisable that it should not be destroyed until it has been examined by some authority capable of determining whether the animal be rabid or not. Owners of dogs are warned of the danger they may incur by allowing their faces and hands (especially if scratched) to be licked by these animals, even if the latter show no sign of madness."

When a person is bitten by a mad animal or snake, at once suck the wound; do not lose a moment. If the wound be in a limb tie the part above the wound, *i.e.*, on the side of the wound which is nearer to the heart—and encourage it to bleed; and then suck it again. This may be done without fear, provided that the operator has no wound on lips, tongue, or mouth. After blood has been well drawn rub into the wound permanganate of potash.

Stings. The pain caused by the stings of wasps, bees, hornets, mosquitoes, etc., may be lessened by a few simple precautions. The sting, when left in the wound by the insect, should be first carefully extracted, and it is a good plan to then press the barrel of a key firmly

round the part. This precaution will prevent the irritating poison from spreading. As the poison is mostly of an acid nature, the application of a little alkali, such as hartshorn, to the injured part, will produce immediate relief. Common soda will answer very well ; and in many cases application of soap, oil, or glycerine to the injured surface is useful.

Bruises and Sprains. When a part of the body is *bruised*, after a time it becomes swollen and discoloured, assuming a blue or blackish tint. Where the skin is not broken, the discoloration may not be seen at first, but in the course of a few days the surrounding skin becomes yellow or red and blue. The discoloration and swelling are due to the escape of blood into the surrounding tissues ; the part should, therefore, be kept at rest, and cold compresses should be applied. Where possible, the injured part should be bathed and kept cool by the application of very cold water. A piece of ice wrapped in linen and made into a cold pad is of great service. In cases where a bruise is associated with abrasion of the skin, it is a good plan to first apply a little *vaseline* to the wounded surface, and then to place the cold pad or ice in position. The tendency to discoloration may be very materially reduced by attending at once to one of the last-named modes of treatment.

The Sprains of Muscles or Joints are often exceedingly troublesome injuries to recover from. They require, in the first place, absolute rest for the part injured. The application of heat gives the greatest ease, therefore the part should be bathed with hot water. The addition of some sea-salt to the water will increase its usefulness.

Some prefer to adopt the "cold water cure." The object then is to keep down the temperature of the injured part by the repeated application of cold water. When the swelling is passing off, the part should be rubbed and carefully exercised. Too prolonged rest is not advisable, as stiffness follows.

Fainting Fits and sudden illness. When a person becomes insensible through *faintness,* it is necessary to decide at once what means to take for his or her recovery. The following simple rules will be found of general use in such cases, but must, of course, be varied according to circumstances :—

1. *Lay the person flat on the back, without a pillow for the head; in fact, if it can be arranged, it is better for the head to be lower than the rest of the body, save in the case of an apoplectic fit.*
2. *Loosen all tight parts of the dress, especially about the neck, chest, and waist.*
3. *If in a close, heated room, church, theatre, etc., remove the patient to the fresh air at once.*
4. *Smelling salts or spirits of hartshorn should be held near the nostrils.*
5. *Cold water should be sprinkled over the face; and should the patient not recover, cold water may be applied to the chest. A towel dipped in cold water will answer for this purpose very well.*
6. *On the return of consciousness, if the patient remains weak, administer stimulants in small doses.*

When the fit is accompanied by restlessness or convulsions, cold should be applied to the head, and the patient should be restrained, and if consciousness does not soon return, medical advice should be obtained. It not unfrequently happens that well-intentioned people try to force liquids into the mouths of those suffering from convulsions ; it is, therefore, well to remember that this practice is attended with the greatest danger.

Convulsions in Children call for great promptitude on the part of those at hand. If the child is fairly strong it should be placed in a warm bath, and the head should be kept cold by a piece of linen or flannel soaked

in cold water. If the child is weak, then a blanket bath should be administered instead of the warm-water bath.

Sunstroke and Heatstroke are, unfortunately, very common in India. While the former usually comes on quite suddenly when a person is exposed to the direct rays of the sun, the latter may be produced at night during the very hot season of the year. When due care is taken to cover the head and back of the neck by means of a turban or sun-hat the liability to sunstroke is reduced to a minimum. Against the causes which tend to produce heatstroke, however, the preventative measures are not so simple. The matters to be attended to are good ventilation of bedrooms and avoidance of overcrowding. Abstinence from all alcoholic liquors is a great safeguard against heat or sunstroke, and a good rule is to avoid sleep immediately after a meal.

When symptoms of sunstroke or heatstroke occur—

1. Carry the patient to a cool, shaded place, or dark room.
2. Remove the clothes at once, and lay the patient in a horizontal position, with the head and shoulders somewhat raised above the level of the body.
3. Pour cold water over the head, chest, and spine, till the patient begins to revive, or until medical aid is obtained.
4. Allow the patient to remain as quiet as possible.

Poisoning. Where a child or adult has taken poison either wilfully or accidentally, it is usually difficult to discover at once the nature of the poison. It is practically impossible in this small work to give precise details of the symptoms which are indicative of different forms of poisoning, but at the same time some general rules may be laid down which should serve as a safe guide in an emergency.

It is first necessary to decide whether it is probable that any case of sudden illness is one of poisoning or not ; and the following points should guide one to rapidly form a conclusion :—

1. In a real case of poisoning the symptoms appear suddenly. Such is rarely the case in diseases, save **apoplexy, sunstroke,** and **cholera.** It therefore follows that when a person is suddenly seized with any of the following symptoms—vomiting, purging, delirium, or insensibility—it is highly probable that poison has been introduced into the body.
2. The symptoms make their appearance after food or drink has been taken.
3. Several persons who have partaken of the same food or drink will develop similar symptoms. Cholera is the only disease which is likely to affect several previously healthy people at the same time.

Classes of Poisons. Having decided that a person has been poisoned, the next point is to determine as far as possible the nature of the poison ; for the course to be adopted in order to afford relief must be varied with the nature of the poison. For convenience, all common poisons may be divided into three classes :—

(*a*) Those which act upon the nervous system are known as **neurotics.**

(*b*) Those known as **corrosives** possess burning properties, and in consequence destroy more or less the membranes of the mouth and throat.

(*c*) Those which act as **irritants** produce inflammation.

The Neurotic Poisons usually contain opium in some form or other, strychnine, chloral or camphor. The symptoms are usually drowsiness and deep sleep.

Some give rise to noisy delirium (belladonna), while others produce cramp and convulsions (strychnine, nux vomica, arsenic). Usually the pupils of the eyes become very much contracted, the breathing becomes noisy, and the skin warm. Vomiting rarely occurs without the administration of an emetic.

Treatment.—As soon as possible administer an emetic such as may be prepared by mixing one ounce of common table salt with six ounces of warm water. This should be given every quarter of an hour until vomiting occurs. A better emetic for adults is prepared by mixing about a quarter of an ounce of powdered mustard to six ounces of water. A still better emetic may be prepared from sulphate of zinc in doses of twenty to forty grains every quarter of an hour, or sulphate of copper dissolved in water in five to ten-grain doses. Since the tendency of poisons of this class is to induce sleep, every effort should be made to keep the patient awake by giving drinks of strong coffee, and by walking exercise ; and cold water should be dashed over the face and neck. In extreme cases, artificial respiration (*see pp. 112-113*) must be resorted to, and kept up for several hours. It is advisable to administer a purgative some hours after vomiting has been induced.

Carbolic Acid. Where this substance has been taken, the inside of the mouth becomes shrivelled and white. The odour may be detected in the breath. The skin and eyelids become cold and clammy.

Treatment. A couple or three teaspoonfuls of Epsom salts followed by an emetic of mustard ; more Epsom salts at intervals, followed by a mixture of olive and castor oil and white of egg in water.

The Corrosive Poisons include all those which tend to destroy the lining membrane of the mouth and alimentary canal. Their action is distinguished at once from all other poisons by the fact that they cause acute pain. Poisons of this class are often called acid

poisons; they include not only strong acids, but alkalies, and also certain metallic substances.

The Acids which are most frequently met with are:—the mineral acids, hydrochloric or muriatic, sulphuric or oil of vitriol, nitric or aqua fortis and oxalic acid.

The Alkalies which commonly give rise to cases of poisoning are caustic soda and fluid ammonia.

The Metallic Substances are such bodies as corrosive sublimate, lunar caustic, and chloride of zinc.

Treatment. A person who has taken a poison belonging to either of these classes usually complains of burning pains in the throat and stomach, accompanied by vomiting and purging. The abdomen swells and collapse soon comes on. **Emetics should not as a rule be administered,** but olive or linseed oil or egg should at once be given.

Where the substance is a mineral acid or oxalic acid, give chalk or magnesia mixed with water or lime water or saccharinated solution of lime. In cases where alkalies have been swallowed, some mild acid should be given, such as acetic acid (vinegar), or the juice of lemons.

The **Irritant Poisons,** which produce excitement and delirium, usually cause a peculiar burning taste, and give rise to thirst, constriction of the throat, and pain in the stomach. In India the best known poisons of this class are croton oil, cantharides, antimony and arsenic. The symptoms vary with the amount, the kind of material, and the individual; but usually they take the form of excitement, and convulsions sometimes occur, followed by sleep and delirium, insensibility and death.

Treatment should be the same as in the cases of neurotic poisoning. The first point to be attended to in both cases is to rid the stomach of the objectionable matter by the action of an emetic, and then to administer

some soothing drink, such as raw egg or egg and milk. When recovering, the patient needs stimulant, such as strong tea or coffee.

General Rules in Cases of Poisoning. The following should be remembered and acted upon :—

1. When a person who has swallowed a poison seems likely to go to sleep as a result of the action of the poison, keep him awake *at all costs*.
2. Should he exhibit a tendency to go off into a fit, throw cold water into his face.
3. When there are no stains about the mouth, nor burning of the skin, give an emetic at once, followed by eggs, milk, linseed or salad, but **not almond oil,** and then strong tea or coffee.
4. In cases where there are stains about the mouth and burning of the skin do not give an emetic, but oil at once, followed by milk, or raw egg and flour beaten up with water.
5. Where phosphorus is the poison suspected **do not give oil,** but frequent doses of magnesia and water may be administered.
6. Never hastily regard a case as hopeless, but prove it. In all ordinary cases take means to empty the stomach by means of an emetic.
7. Continue your efforts to restore the patient and to give relief, even if at first they appear unavailing. It may be necessary to continue to work for several hours before an improvement is observable.
8. Carefully watch the patient even when apparently quite recovered, for the symptoms often reappear after a time.
9. When sending for medical aid, give the doctor all the particulars possible, in order that he

may provide himself with remedies best suited to meet the case. Bear in mind the importance of expedition.

Common Emetics and Antidotes. In cases where other emetics are not readily obtainable, two tablespoonfuls of mustard mixed in a pint of warm water should be rapidly prepared and given to the patient. As stated above, where a corrosive poison has been taken great care must be exercised in the administration of an emetic, and in most cases a soothing mechanical antidote only should be given. It is also a safe plan in most cases to give large draughts of warm milk, or water mixed with salad oil, or water mixed with white of egg and salad oil, butter or lard. Where medical advice is unobtainable at once, then the following antidotes should be employed :—

Poisons.	*Treatment.*
Strychnine ... ... Tincture Nux Vomica	Emetic of Mustard aided by warm water.
Arsenic ... ... White Precipitate ...	Emetic of mustard and salt at once. After vomiting, give salad oil.
Copperas	Milk, Cream or Butter.
Blue Vitriol ... ... Sugar of Lead ... Sulphate of Zinc ... Corrosive Sublimate... Red Precipitate ... Vermilion	Milk or white of eggs or a mixture of these in large quantities.
Tartar Emetic ... Antimonial Wine ...	Warm water at first, to stimulate vomiting, and then to check the vomiting give a grain of opium in water.
Quick Lime ... ... Caustic Soda ... ... Caustic Potash ... Spirit of Hartshorn ... Fluid Ammonia ...	Water should be freely given, to which lemon juice or vinegar has been added.

Oxalic Acid ... ... Oil of Vitriol ... ... Muriatic Acid... ... Aqua Fortis	Give soap or magnesia or chalk, mixed with water, every two minutes.
Carbolic Acid... ...	Give flour and water or glutinous drinks.
Chloroform ... ... Ether ... ... Chloral Hydrate ...	Pour cold water over head, face and neck. Induce artificial respiration by the method explained upon pp. 112-113.
Laudanum ... ... Morphine ... ... Opium	Strong coffee followed by ground mustard in warm water to stimulate vomiting. Then administer strong coffee again. Keep the patient in motion.

Antidotes are substances which are either given in order to combine with and neutralize the poisonous material by converting it into a harmless substance, or bodies which have some counteracting influence upon the body as a whole, or the nervous system in particular, and thus correct the influences of the poison. As examples of the former group, the antidote for oxalic acid and the mineral acids is chalk or magnesia and for arsenic is dialysed iron or magnesia, and for tartar-emetic is tannin. Examples of bodies which act in the latter way we have in the opium which, after an emetic, is given in cases of poisoning by belladona ; and chloral, after emetics, in strychnine poisoning.

Foreign bodies in the eyes, nose, and ear. It not unfrequently happens that particles of dust, pieces of stone or metal, insects, etc., lodge under the eyelids, and give rise to much irritation. Any of the above may usually be removed with the folded corner of a silk handkerchief or a moistened camel hair brush. If much dust has passed under the eyelid it may generally be removed by carefully syringing with warm water. After the removal of the irritating substance,

if the eye continues to be painful, it is a good plan to drop between the lids a little sweet or olive oil. If the pain still continues, a cold, wet compress should be applied. Quicklime, pieces of mortar, or other matters which are likely to irritate and burn, sometimes find their way under the eyelid. They should be removed as speedily as possible, and the eye should be bathed with warm water and a little oil dropped between the lids.

Young children sometimes push pieces of pencil, parts of toys, beads, marbles and such like rounded substances, into the nostrils. They should be at once carefully removed, if possible ; if it is difficult to do this, a surgeon should be consulted.

Flies and insects sometimes find their way into the ears. Occasionally children introduce into the tube of the ear bodies similar to those passed into the nose. The ear should, in such cases, be syringed out with warm water. The nozzle of the syringe should not be introduced within the ear but should be held just outside the opening, and a little glycerine or oil dropped into the passage ; but if the body is a solid, like a bead or piece of pencil, and it is not washed out by the syringing, then medical aid should be called in. The inexperienced should not try to remove the foreign body except by syringing, for efforts in this direction may result in injury to the delicate drum of the ear.

Restoring the Apparently Dead. The following system is recommended by the Royal Humane Society of London :—

If from drowning, suffocation, or narcotic poisoning, send for medical assistance, blankets, and dry clothing, but proceed to treat the patient instantly.

The points to be aimed at are—first, and immediately, the restoration of breathing ; and *secondly*, after breathing is restored, the promotion of warmth and circulation.

The efforts to restore life must be persevered in until the arrival of medical assistance, or until the pulse and breathing have ceased for an hour.

RULE 1.—*To adjust the Patient's Position.* Place the patient on his back on a flat surface, inclined a little from the feet upwards; raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder-blades. Remove all tight clothing about the neck and chest.

RULE 2.—*To maintain a Free Entrance of Air into the Windpipe.* Cleanse the mouth and nostrils; open the mouth; draw forward the patient's tongue, and keep it forward: an elastic band over the tongue and under the chin will answer this purpose.

RULE 3.—*To imitate the Movements of Breathing.*

First.—**Induce Inspiration.** Place yourself at the head of the patient, grasp his arms, raise them upwards by the sides of the head, stretch them steadily but gently upwards for two seconds. [*By this means fresh air is drawn into the lungs by raising the ribs.*]

Secondly.—**Induce Expiration.** Immediately turn down the patient's arms, and press them firmly but gently downwards against the sides of his chest, for two seconds. [*By this means foul air is expelled from the lungs by depressing the ribs.*]

Thirdly.—**Continue these Movements.** Repeat these measures alternately, deliberately, and perseveringly, fifteen times in a minute, until a spontaneous effort to respire be perceived. [*By these means an exchange of air is produced in the lungs similar to that effected by natural respiration.*

When a spontaneous effort to respire be perceived, cease to imitate the movements of breathing, and proceed to induce circulation and warmth (*as below*).

RULE 4.—*To excite Respiration.* During the employment of the above method excite the nostrils with snuff or smelling salts, or tickle the throat with a feather. Rub the chest and face briskly, and dash cold and hot water alternately on them. Friction of the limbs and body with dry flannel or cloths should be had recourse to. When there is proof of returning respiration, the individual may be placed in a warm bath, the movements of the arms above described being continued until respiration is fully restored. Raise the body in twenty seconds to a sitting position, dash cold water against the chest and face, and pass ammonia under the nose. Should a galvanic apparatus be at hand, apply the sponges to the region of the diaphragm and heart.

Treatment after Natural Breathing has been Restored. *To induce circulation and warmth.* Wrap the patient in dry blankets, and rub the limbs upwards energetically. Promote the warmth of the body by hot flannels, bottles or bladders of hot water, and heated bricks, applied to the pit of the stomach, the armpits, and to the soles of the feet.

On the restoration of life, when the power of swallowing has returned, a teaspoonful of warm water, small quantities of wine, warm brandy and water, or coffee should be given. The patient should be kept in bed, and a disposition to sleep encouraged. During reaction large mustard plasters to the chest and below the shoulders will greatly relieve the distressed breathing.

Note.—In all cases of prolonged immersion in cold water, when the breathing continues, a warm bath should be employed to restore the temperature.

If from intense Cold. Rub the body with snow, ice, or cold water. Restore warmth by slow degrees. It is highly dangerous to apply heat too early.

If from Intoxication. Lay the individual on his side on a bed, with his head raised. The patient should be induced to vomit. Stimulants should be avoided.

If from Apoplexy or from Sunstroke. Cold should be applied to the head, which should be kept well raised. Clothing removed from the neck and chest. Stimulants avoided.

Appearances which generally indicate Death. There is no breathing or heart's action; the eyelids are generally half-closed; the pupils dilated; the jaws clenched; the fingers semi-contracted; the tongue appearing between the teeth, and the mouth and nostrils covered with a frothy mucus. Coldness and pallor of surface increases.

The treatment recommended by the Society is to be persevered in for three or four hours. It is an erroneous opinion that persons are beyond recovery because signs of vitality do not soon make their appearance, as cases have come under the notice of the Society of a successful result even after five hours' perseverance.

CHAPTER XVI.

THE INFECTIOUS DISEASES OF CHILDHOOD.

Infectious Diseases are due to the growth of small living organisms, commonly known as germs or microbes, which are so extremely minute that they can only be seen by means of the most powerful microscopes. Infection means communicating a disease from one person to another. Each disease has its own special germ which gives rise to the disease; *e.g.*, typhoid germs produce typhoid. Each kind of germ reproduces its own kind, generally by dividing again and again, and thus producing new organisms. This division, or multiplication, goes on very rapidly, so that one fever germ will produce seventeen thousand or more of its kind in twenty-four hours. The various symptoms of infectious diseases result from the growth of these organisms in the blood and tissues of the body. These microbes of disease are then thrown off from the body, sometimes in the breath or from the skin, or in

the excretions, and so they may infect other people directly, or they may be carried by air, water, clothes, flies, cats or dogs, and so be breathed in or swallowed by people at a distance.

When disease-producing living dust is introduced into the body, either with the air breathed or with the liquid or food swallowed, if the conditions are favourable the microbes rapidly grow and multiply, and so change the blood and other fluids that diseases are set up. During the growth of these disease germs poisonous bodies are also produced, to which some of the symptoms of the complaint are due. So far as children are concerned, the most common means by which disease germs are introduced into the system are water and milk. Among the diseases which may be conveyed by *milk* are diphtheria, typhoid fever, tuberculosis, and scarlet fever.

The course of an infectious fever is divided into the following states or periods :—

1. *Incubation, or Sickening.*—An interval between the disease being "caught" and the appearance of definite signs. There may be an indefinite feeling of uneasiness, loss of vigour, etc., but sometimes there are no signs of illness.

2. *Invasion.*—The increasing multiplication of the germs and particularly the products of their activity now poison the whole system. This stage is often ushered in by a shivering fit. It is marked by a rise of temperature. In this stage the rash (if any) appears. The invasion stage runs a definite course of days or weeks, according to the disease.

3. *Defervescence, or Decline.*—The period of returning to normal temperature. This may be by *crisis*, a sudden improvement, but more generally by *lysis*, a gradual improvement. In this stage great care is necessary to avoid "relapse" and complications.

Common Infectious Diseases of Childhood. The common ailments, such as whooping cough, measles and scarlet fever, which are looked upon in England as essentially infantile complaints, and from one or more of which so few children escape in cold countries, are either unknown or contracted in such a mild form in the tropics that they are not usually to be considered serious. It will, however, often relieve a mother's anxiety to know how long after a child has been exposed to an infectious disease there is danger that the disease has been contracted. The following table gives the period of incubation, the time during which the child is sickening for the disease, and the other information concerning these complaints :—

Disease.	Symptoms usually appear	Anxious period extends from	Period of Infectivity.
Whooping Cough*	Within 14 days	7-14 days	Six weeks from beginning to whoop.
Scarlet Fever ...	,, 4 ,,	1-7 ,,	Until scaling has ceased.
Measles† ...	,, 14 ,,	10-14 ,,	Until scaling and cough have ceased.
Typhoid Fever ...	,, 11 ,,	1-28 ,,	Until diarrhœa ceases.
Mumps	,, 10-22 ,,	16-24 ,,	Fourteen days from commencement.
Diphtheria ...	,, 2 ,,	2-5 ,,	Fourteen days after disappearance of membrane.
Chicken-pox ...	,, 14 ,,	10-18 ,,	Until all scabs have fallen off.
Small-pox ...	,, 12-17 ,,	1-14 ,,	,, ,,

* In whooping cough the patient is infectious during the early stages of the primary cough, which may be three days before the whooping begins.

† In measles the patient is infectious three days before the eruption appears.

Symptoms of Infectious Diseases of Childhood. Where medical aid is not readily available, the following table may aid a mother in determining any one of the diseases mentioned :—

Disease.	Nature of Eruption or Symptoms.	Appearance.	Duration.
Whooping Cough	Catarrh, sneezing, watering of the eyes, feverishness and cough.	10 to 14 days.	4 to 7 weeks, or longer.
Scarlet Fever ...	Bright scarlet, diffused.	2nd day of fever, or after 24 hours' illness.	8-19 days.
Measles	Small red dots, like flea-bites.	4th day of fever, or after 72 hours' illness.	6-10 days.
Typhoid Fever ...	Rose-coloured spots, scattered.	7th to 14th day.	22-30 days.
Mumps	Fatigue, feverishness, sore throat, swelling of the face.	2nd to 3rd week.	21 days.
Chicken-pox ...	Small rose-pimples, changing to vesicles.	2nd day of fever, or after 24 hours' illness.	6-7 days.
Small-pox ...	Small red-pimples, changing to vesicles, then pustules.	3rd day of fever, or after 48 hours' illness.	14 21 days.

Prevention of the Spread of Infectious Diseases. When small-pox, cholera, diphtheria, measles, typhoid or scarlet fever has broken out in a house, the first thought should be to prevent its spread.

1. Separate the sick, without delay, from the rest of the household, by removal where possible, or by complete isolation, with a sheet well wetted with disinfectant hung outside the bedroom door.

2. The room selected should be airy, and where possible, in the hill districts, the one selected should have a fireplace.

3. Remove at once all furniture that can be spared, and anything that may harbour dust, dirt, or infection.

4. Give strict orders that no communication be held with the sick room, except through the nurse or some authorised person who has had the disease.

5. Examine house-drains and water-closets, where such exist, or other sanitary appliances, sinks, dustbins, and any possible sources of nuisance; remedy defects and disinfect freely. In times of epidemic, the sewers should be disinfected, and all arrangements for the reception, removal or disposal of excreta should be inspected and disinfected.

6. Look to sources of water supply, house cisterns, water-butts, pumps, wells, and all utensils employed for the collection or storage of drinking water for impurities and contamination by sewage. Water which is clear and pleasant to the taste may still be charged with sewer poison. See that all drinking and cooking water is boiled before use.

7. Children living in an infected dwelling should not attend schools or visit other houses.

8. Persons recovering from scarlatina should on no account be allowed to mix with their fellows until several baths have been taken and the peeling is completed.

9. The bodies of persons who have died of fever are infectious, and should be carefully and immediately isolated. They should be buried with the least possible delay.

10. *In the sick-room,* nothing can replace *fresh air, light*, and *cleanliness*. Scents are useless.

11. Remove all superfluous furniture, carpet, curtains, hangings, etc., set everything in order, and clean up. If the room is not isolated, hang a sheet before the door outside, and keep well wetted three or four times daily with Condy's Fluid or Carbolic Acid. Avoid stuff dresses.

12. Keep within reach a basin with Condy's Fluid to spit into; and where there is no fire to burn them, a large basin containing disinfectant to receive the squares of rag used in place of handkerchiefs.

13. *Disinfectants are Poisons.* Bottles containing them must be put away, and not allowed to stand with ordinary medicine bottles.

14. Disinfect and remove as soon as possible all discharges from the body of the sick.

15. Pour disinfectant freely over excreta and down sinks.

16. In scarlatina, oil the body when the skin is peeling, twice daily, and use warm baths with soap.

17. When sickness is come to an end, disinfect the room and all that has been in contact with the invalid.

CHAPTER XVII.

SIMPLE FOODS FOR CHILDREN AND INVALIDS IN INDIA.

1.—MILK AND MELLIN'S FOOD.

Ingredients:—Mellin's Food, two heaping tablespoonfuls.
Hot Water, two tablespoonfuls.
Milk, sufficient to make a pint.

To prepare—

Place the Mellin's Food in a jug, add a tablespoonful of hot (not boiling) water, and stir the whole into a paste; then add the rest of the hot water and stir again; next add the milk, with constant stirring.

2.—BREAD AND MILK.

Ingredients:—One thick slice of bread.
Half a pint of milk.
Mellin's Food to taste.

To prepare—

Cut the bread into cubes; place the same in a small basin; pour on boiling milk; allow to stand for a few minutes covered; sprinkle Mellin's Food and a little salt over when served.

3.—MELLIN'S BISCUITS AND MILK.

Ingredients :—Milk, one half pint.
Six or eight Mellin's Food Biscuits.

To prepare—

Bring the milk to scalding point, about 140° F., place the Biscuits in a breakfast cup or small basin and pour over them sufficient of the hot milk to cover them (about five tablespoonfuls). Allow them to stand six minutes, then with a spoon mix the softened Biscuits into a smooth paste, and finally add the remainder of the milk.

4.—MILK AND EGG WITH MELLIN'S FOOD.

Ingredients :—Two eggs.
One tablespoonful of Mellin's Food.
One pint of milk.

To prepare—

Beat the eggs well, turn on to the Mellin's Food previously dissolved in a little warm water, mix thoroughly and add the milk.

5.—WHITE OF EGG AND MILK.

Ingredients :—The white of two eggs.
Two tablespoonfuls of milk.
One dessertspoonful of Mellin's Food.

To prepare—

Boil the milk and let it cool; whip the white of the eggs and put into a tumbler; dissolve the Mellin's Food in a little warm water; add this to the milk, then add the whole to the beaten eggs and stir.

6.—BLANC-MANGE (CORNFLOUR).

Ingredients :—One-fourth teacup of cornflour.
One pint of milk.
One dessertspoonful of sugar.
Two tablespoonfuls of Mellin's Food.

To prepare—

Add sufficient milk to the cornflour to produce a smooth paste ; put the remainder of the milk on to boil ; pour the boiling milk on to the cornflour paste ; return the whole to the saucepan and boil gently with constant stirring for ten minutes ; after well boiling remove from the saucepan, add the sugar and Mellin's Food, and stir again well for a few seconds ; pour into a mould previously rinsed with cold water.

7.—BLANC-MANGE (RICE).

Ingredients :—Half-a-teacupful of ground rice.
One pint of milk.
One dessertspoonful of sugar.
Two tablespoonfuls of Mellin's Food.
A strip of fresh lemon rind.

To prepare—

Follow the directions given above for Cornflour Blanc-Mange. It should be remembered that cornflour and rice must be very thoroughly boiled in order to cook the starch and render it digestible. A little Mellin's Food may be sprinkled over the Blanc-Mange when served.

8.—BLANC-MANGE (IRISH MOSS).

Ingredients:—One-fourth teacup of Irish or Iceland Moss.
One pint of milk.
A pinch of salt.

To prepare—

Soak the moss in cold water a few minutes, then pick it over carefully and wash. Tie in a muslin bag, put with the milk into a double boiler and boil until the milk thickens when dropped on a cold plate. Add the salt and take out the bag, first pressing it gently; then turn the thickened milk into a mould. Eat with sugar and cream and Mellin's Food.

9.—PLAIN JUNKET. (This is sometimes called "curds and whey.")

Ingredients:—Half-a-pint of good milk.
Rennet.

To prepare—

Take one half-pint of raw milk and heat it lukewarm; then add a teaspoonful of essence of pepsin or liquid rennet and stir the mixture thoroughly; pour into custard cups and let it stand until firmly curdled.

10.—CUSTARD WITH MELLIN'S FOOD.

Ingredients:—One half-pint of milk.
Two eggs.
One dessertspoonful of sugar.
One dessertspoonful of Mellin's Food.
A pinch of salt.

To prepare—

Dissolve the Mellin's Food in a little warm water; put the milk into a double saucepan and allow it to become scalding hot; beat the eggs thoroughly and add the scalding milk to them gradually; then return the whole to the double boiler, add the Mellin's Food, sugar

and salt, and cook for two or three minutes, stirring constantly. This can be varied by beating the white and yolk of the egg separately; proceed as above, only reserving the stiffly-beaten white, and stir into the custard just before taking from the fire.

11.—CUSTARD PUDDING.

Ingredients:—One teacupful of fresh milk.
Two eggs.
One tablespoonful of sugar.
One tablespoonful of Mellin's Food.
A pinch of salt.

To prepare—

Beat the eggs slightly in a basin, add the milk, sugar and Mellin's Food; pour into a buttered pie dish and bake in a moderate oven for thirty minutes. If quickly baked it will become full of holes and watery. It must not boil.

12.—CUSTARD PUDDING.

Ingredients:—Two cups of fresh milk.
Four eggs.
One tablespoonful of sugar.
Two tablespoonfuls of Mellin's Food.
A pinch of salt.

To prepare—

Beat the eggs slightly, add the sugar and Mellin's Food, and whip them together until smooth and creamy. Stir the milk (salted very slightly), pour into a dish and set this in a dripping-pan full of boiling water until the middle of the custard is "set"; take directly from the oven; eat cold.

13.—TAPIOCA CREAM.

Ingredients:—Two tablespoonfuls of pearl tapioca.
One pint of milk.
Four eggs.
Two tablespoonfuls of Mellin's Food.
A little salt.

To prepare—

Pick over and wash the tapioca and soak in warm water until it has thoroughly softened; then add the milk and boil in a double saucepan until the tapioca is transparent; beat the yolks of the eggs and the Mellin's Food together, turn the boiling tapioca upon them and return to the fire for three or four minutes; take from the fire, add the whites of the eggs beaten very stiff and mix thoroughly. If two eggs only be used, the cream will still be very palatable.

14.—RICE MILK.

Ingredients:—Two tablepoonfuls of rice.
Two tablespoonfuls of Mellin's Food.
Two coffee cups (one pint) of milk.
One tablespoonful of sugar.
One-half teaspoonful of salt.

To prepare—

Wash the rice and put with the milk and salt into a double saucepan; cook until the rice is very soft and has absorbed most of the milk; when almost done, add the Mellin's Food and the sugar dissolved in a little hot water.

15.—MILK JELLY.

Ingredients :—Half-an-ounce of sheet gelatine.
One pint of milk.
One dessertspoonful of sugar.
Two tablespoonfuls of Mellin's Food.
A strip of lemon rind.

To prepare—

Place the lemon rind in the milk in a small enamelled saucepan and bring it carefully to the boiling point; when boiling, pour it on to the gelatine in a basin and stir gently until the whole of the gelatine is dissolved; then add the Mellin's Food and sugar and stir again until the whole has the consistency of cream; set in moulds previously rinsed in cold water; when firm, dip the moulds quickly into hot and then into cold water and turn out for use. Unless the milk jelly is allowed to partly thicken before being placed in the moulds it will separate out.

16.—RICE JELLY.

Ingredients :—One-half teacup of rice.
Three teacups of cold water.
One teacup of fresh milk.
One-fourth teaspoonful of salt.
Piece of soda not larger than a pea, dropped into the milk.

To prepare—

Wash the rice and then soak it for four hours in just enough water to cover it; add, without draining, to the cold water; bring to the boil in a double saucepan and cook until the rice is broken all to pieces and the water reduced to half the original quantity; add the milk and simmer (covered) for half-an-hour; strain through coarse muslin, pressing and twisting *hard*; sweeten slightly and use when it has cooled sufficiently.

17.—OAT JELLY.

Ingredients :—Half-a-teacupful of coarse oatmeal.
One quart of water.

To prepare—

Soak the oatmeal in one quart of cold water for twelve hours ; at the end of this time boil down to one pint and strain through fine muslin while hot ; keep the resulting jelly on ice until needed. Serve with Mellin's Food sprinkled over.

18.—RICE PUDDING.

Ingredients :—Three tablespoonfuls of rice soaked three hours in cold water.
Two cups of milk.
A little salt.
Two beaten eggs.

To prepare—

Drain the rice in a colander lined with a piece of coarse cloth, and put it in a double saucepan with enough cold water to cover it ; add the salt ; cover closely and steam until soft, shaking up the inner kettle now and then but never putting a spoon into it. When rice is cooked in this way each grain will keep its shape and be separate from the rest. Try one to see if it is quite tender before taking the vessel from the fire. Should the water not be entirely absorbed, drain off what is left ; shake up the rice that it may lie lightly and loosely, and pour in the milk. This (warm but not scalding) should be ready in another saucepan. Return to the fire ; simmer fifteen minutes ; boil up well once ; turn into a bowl and beat in the frothed eggs at once. Sprinkle over the surface, when served, Mellin's Food to flavour, or eat with cream and sugar.

19.—MELLIN'S FOOD, *prepared to alternate with* 15 *and* 16.

Ingredients :—Four teaspoonfuls of Mellin's Food.
Six fluid ounces (12 tablespoonfuls) milk.
Two fluid ounces of water.

To prepare—

Mix the Mellin's Food with warm water; then add the milk, with constant stirring.

20.—OATMEAL PORRIDGE (ROLLED OATS).

Ingredients :—One breakfastcupful of boiling water.
Half-a-teacupful of rolled oats.
Half-a-teaspoonful of salt.

To prepare—

To one breakfastcupful of boiling water add half-a-teaspoonful of salt and half-a-cupful of rolled oats. Boil two hours in a double saucepan and strain through a sieve. For a child about fifteen months old, two or three tablespoonfuls of the strained part is enough for one meal, the rest being saved to heat for another meal. To the part used, add enough milk with a little Mellin's Food dissolved in it to make a soft oatmeal pulp. For a child two or three years old, three or four tablespoonfuls of the strained oatmeal may be given at a meal. Add just enough milk with Mellin's Food to soften it.

21.—OATMEAL PORRIDGE.

Ingredients :—Two teacupfuls of boiling water.
Half-a-teacupful of coarse oatmeal.
Half-a-teaspoonful of salt.

To prepare—

To two teacupfuls of boiling water add one half-teaspoonful of salt and one half-teacup of coarse oatmeal; boil four hours in a double saucepan and strain through a sieve. For a child about fifteen months old, two or three teaspoonfuls of the strained part is enough for one meal, the rest being saved to heat for another meal. To the part used, add enough milk with a little Mellin's Food dissolved in it to make a soft oatmeal pulp. For a child two or three years old, three or four tablespoonfuls of the strained oatmeal may be given at a meal. Add just enough milk with Mellin's Food to soften it.

22.—SOFT BOILED EGGS.

To prepare—

Drop two eggs into enough boiling water to cover them; let them stand on the back of the stove where the water will keep hot, but not boil for eight minutes. An egg, to be properly cooked, should never be boiled in boiling water, as the white hardens unevenly before the yolk is cooked. The yolk and white should be of jelly-like consistency.

23.—DRIED BREAD.

To prepare—

Either stale or fresh bread may be used; it is cut in thin slices and placed in the oven with the door opened and quickly dried until it is crisp but not browned. It is in many respects the best form in which to give bread to young children.

24.—CHICKEN, VEAL AND MUTTON BROTHS.

To prepare—

The fleshy part of the knuckle of veal ; a chicken, bones and all chopped up ; or two pounds of the scrag end of neck of mutton, added to two pints of water with a little salt and boiled two hours and strained : all make excellent broths. Cool thoroughly, then carefully remove the fat by skimming with a spoon or a clean piece of blotting paper, and heat again when required for use. Pearl barley, rice or vermicelli boiled separately till quite soft may be added when either of the broths is heated for use.

25.—BEEF TEA.

Ingredients:—Quarter-pound of gravy beef.
One gill of water.

To prepare—

Cut the beef very finely, or tear it into shreds, removing all skin and fat. Then place it in a stone jar with one gill of water, place the lid on the jar, and tie a piece of paper over it. Stand the jar in a saucepan of cold water, place the saucepan over a fire and bring the water to the boiling point, allowing the jar to remain thus for three hours. At the end of this time salt to taste and pour the beef tea into a cup for use.

26.—SCRAPED MEAT.

To prepare—

Take a piece of raw juicy steak and scrape away the pulp of the meat with a dull knife ; place this meat pulp (as much as is needed) on a piece of toast or stale bread and bake in the oven for five minutes ; flavour with salt and a small amount of butter ; it may be given either with or without the toast.

27.—BEEF TEA.

Ingredients:—Half-pound of gravy beef.
Half-pint of water.
A pinch of salt.

To prepare—

Cut the beef into very small pieces, taking care to remove all fat and skin, and place in a saucepan with half-a-pint of cold water and a good pinch of salt. Place the saucepan on the fire and stir the contents until almost boiling, then remove to the side of the fire and allow to simmer gently for one hour; after this pour out the beef tea and let it cool, removing any fat before using. Beef tea must not be allowed to boil during preparation.

28.—BAKED APPLES WITH MELLIN'S FOOD.

To prepare—

Pare and core the apples, fill the cavities with Mellin's Food (dry), scatter sugar over them, put a little boiling water in the baking dish and bake in a quick oven.

29.—APPLE STEW.

To prepare—

Pare and slice three or four ripe apples, pack them into a porcelain dish, cover barely with cold water to prevent scorching, cook gently in the oven until they are very soft. Turn out into a bowl and mash with a wooden spoon, press with the same through a colander and sweeten to taste with sugar or Mellin's Food while warm.

Apple stew prepared as described above is wholesome, pleasant to the taste and slightly laxative to the bowels. It should be eaten with bread and butter or rice pudding.

CHAPTER XVIII.

SIMPLE DRINKS FOR CHILDREN AND ADULTS.

1.—WHITE OF EGG AND SODA WATER.

Ingredients :—Two whites of eggs.
Half-a-tumbler of soda water.
Mellin's Food to flavour.

To prepare—

Dissolve the Mellin's Food in the least possible quantity of warm water ; add the whites of eggs and whip into a froth ; pour into a glass and add the soda water.

2.—MILK AND SODA WATER.

Ingredients :—Half-a-tumbler of milk.
Half-a-tumbler of soda water.

To prepare—

Pour the milk into a tumbler and fill up with soda water. This renders the milk more digestible. The soda water tends to divide the casein of the milk into fine flakes and thus prevents the formation of hard indigestible clods of curd.

3.—LEMONADE.

Ingredients :—Quarter pound of sugar.
One fine juicy lemon.

To prepare—

Remove in a thin layer the outer rind from the lemon; then remove the white pulp beneath, which latter is to be thrown away. Well pound up the lemon rind and pour it on to the strained juice of the fruit. Press the mixture into a jar, and when required for use, dissolve a tablespoonful of it in a glass of water. Or for immediate use the mixture may be placed in a jug and a pint of boiling water poured upon it; when cool it is ready for use.

4.—ORANGEADE.

Ingredients :—Two juicy oranges.
One juicy lemon.
Six lumps of sugar.
One pint of boiling water.

To prepare—

Thinly peel the lemon, squeeze the juice from the oranges and the lemon into a jug, add the lemon peel and sugar, and pour on the boiling water. Cover and strain when cold.

5.—TOAST WATER.

Ingredients :—One crust of bread, toasted deep brown and hard.
One pint of cold water.

To prepare—

Place the toasted bread in a jug, add fresh cold water and let it stand for one hour. Strain, and it is then ready for use.

This drink should be clear and of brownish colour.

6.—RICE WATER.

Ingredients :—Two ounces of rice.
One quart of water.
Lemon peel.

To prepare—

Wash well the rice with cold water, then soak for three hours in a quart of water kept at tepid temperature; afterwards gently boil the whole for one hour and then strain off the liquid. Place aside to cool and flavour with orange or lemon peel, cloves, or cinnamon for use.

This drink is very useful in cases of diarrhœa.

7.—APPLE WATER.

Ingredients :—Six juicy apples.
White sugar.
One quart of boiling water.

To prepare—

Clean six juicy apples, and without removing peel or core, cut them into thin slices. Place in a large jug and add a few pieces of lemon rind, cut very thinly; pour on one quart of boiling water, and add white sugar to sweeten. Strain when cold.

8.—GELATINE AND MILK.

Ingredients :—Quarter-ounce of gelatine.
Quarter-pint of hot barley water.
Half-ounce of best loaf sugar.
Half-pint of hot milk.

To prepare—

Place the gelatine in a jug. Then pour the boiling barley water on to the loaf sugar in a separate vessel. When the sugar has dissolved, and while the mixture is still very hot, pour it on to the gelatine. Then add the hot milk and stir well.

This mixture is very useful in cases of vomiting and diarrhœa, and is best given cold.

9.—ALMOND WATER.

Ingredients:—One ounce of compound powder of almonds
Half-pint of hot water.

To prepare—

Place the compound powder of almonds, which ma be obtained from any chemist, in a clean jug, and pou on the hot water, which should not be boiling. Allow to stand for fifteen minutes, and then strain through muslin.

This will be found a very useful and agreeable drink i cases of cold, bronchitis, or simple lung troubles.

10.—LINSEED TEA.

Ingredients:—Half-ounce of whole linseed.
Half-ounce of powdered white sugar.
Quarter-ounce of liquorice root.
A few drops of lemon juice.
One pint of boiling water.

To prepare—

The whole linseed (not linseed meal), the sugar an liquorice root should be placed in a jug, and then on pint of boiling water should be poured over the whole The jug should then be placed near the fire for fo hours and afterwards removed. When the contents a cool, the clear liquor should be strained off and a fe drops of lemon juice added, sufficient to impart a agreeable flavour.

This mixture will be found very soothing in cases severe cough or chest troubles. It should be given warm.

MELLIN'S FOOD AND ICED SODA WATER.

Mellin's Food—In a large glass mix one tablespoonful with sufficient cold boiled water to produce a thin paste. Pour on the soda water and stir the mixture.

This will be found a most refreshing and sustaining food beverage during the hot season, and it is taken with relish and advantage when other foods are repugnant.

For those suffering from the effects of sunstroke or typhoid this preparation has been used with the greatest benefit.

MELLIN'S FOOD WITH SODA AND MILK.

Milk, one-third pint.
Soda water, two-thirds pint.
Mellin's Food, one tablespoonful.

Well stir the Mellin's Food with milk until the whole of the powder is dissolved, and then add iced soda water.

MELLIN'S FOOD FOR DYSPEPTICS.

Mellin's Food—Two tablespoonfuls.

Milk—Four fluid ounces.

Water—Sufficient to produce a paste with the Mellin's Food before mixing.

Cocoa—One heaping teaspoonful.

To be taken morning and evening.

FOR THE AILING.

Mellin's Food.—One tablespoonful.

Milk.—One half-pint.

Eggs.—Three new-laid, well beaten up with the milk.

Salt.—To flavour.

FOR NURSING MOTHERS.

Mellin's Food—One tablespoonful.
Milk—Four fluid ounces.
Water—Enough to make the Mellin's Food into a paste.
Egg—One new-laid, beaten up with the milk.
To be taken three times a day, or more frequently.

FOR INVALIDS.

Mellin's Food—One tablespoonful.
Milk—Four fluid ounces.
Water—Sufficient to make the Mellin's Food into a paste.
Sweet Cream—Two tablespoonfuls.
Egg—One, beaten up with the milk.

FOR THE AGED.

Mellin's Food—Two tablespoonfuls.
Milk—Four fluid ounces.
Water—Sufficient to make a paste with the Mellin's Food.

IN CASES OF CHOLERA INFANTUM AND TYPHOID.

Mellin's Food—Three teaspoonfuls.
Water—Three fluid ounces.
To be given cold at frequent intervals.

OTHER USES OF MELLIN'S FOOD.

MELLIN'S FOOD may, with advantage, also be added to porridge, arrowroot, sago, rice, and other farinaceous food, to increase their nutritive value and digestibility. The food value of cocoa, coffee and tea may be increased by the addition of Mellin's Food.

CHAPTER XIX.

USEFUL RECIPES.

WHEY (ABOUT ONE PINT).

To prepare—

Place one pint of fresh milk in an enamelled saucepan, and warm it to blood heat (about 98° F. to 100° F.); then pour into a clean jug. Next add as much rennet powder as will stand on a threepenny piece, or one teaspoonful of rennet essence may be used instead. Stir well, stand in a warm place until firmly clotted, break up the clot by stirring, and strain through fine muslin. The clear liquid is whey.

LIME-WATER (ONE PINT).

To prepare—

To one pint of cold boiled water in a clean jug add as much freshly-slaked lime* as will stand upon a sixpence. Stir the mixture thoroughly and stand aside for one hour; then pour off the clear liquid, taking care not to disturb the sediment at the bottom; or the milky mixture may be filtered through a piece of clean filter or white blotting-paper ten minutes after preparation. Preserve the solution in a well-stoppered bottle.

* The lime or lime-water may be obtained at any chemist's.

SACCHARINATED SOLUTION OF LIM

To prepare—

Carefully grind together in a mortar two ounc best powdered white sugar and one ounce of slaked When thoroughly mixed, place the powder in a and add a pint of boiled water. Well shake the mix Preserve the solution in a well-stoppered bottle.

Of this solution 15 minims would correspon strength to a tablespoonful of lime-water.

BARLEY-WATER (ONE PINT).

To prepare—

Take three teaspoonfuls of pearl barley, wash it with cold water and then with hot water; throw the washings. Add one pint and a half of water boil slowly down to about one pint, stirring occasion Strain when the boiling is completed. It is prefe to use a double boiler. A whole day's supply shoul be made at one time, for the liquid soon turns sou becomes unfit for use.

WEIGHTS AND MEASURES.

MEASURES OF CAPACITY.

1 minim	= 1 drop.	
1 drachm	= 1 teaspoonful	= $\frac{1}{16}$ chittack.
2 drachms	= 1 dessertspoonful	= $\frac{1}{8}$,,
4 drachms	= 1 tablespoonful	= $\frac{1}{4}$,,
60 minims	= 1 drachm (ʒ)	= $\frac{1}{16}$,,
8 drachms	= 1 ounce (℥)	= $\frac{1}{2}$,,
20 ounces	= 1 pint	= 10 ,,
4 gills	= 1 pint	= 10 ,,
2 pints	= 1 quart	= $1\frac{1}{4}$ seers.

AVOIRDUPOIS WEIGHT.

16 drachms	= 1 ounce ($437\frac{1}{2}$ grains)	= $\frac{1}{2}$ chittack.
16 ounces	= 1 pound	= $\frac{1}{2}$ seer.
14 pounds	= 1 stone	= 7 seers.
28 ,,	= 1 quarter	= 14 ,,

Standard Measure.	*Popular Measure.*
mi One Minim	1 Drop
ʒi One Drachm (60 Minims)	1 Teaspoonful
ʒij Two Drachms	2 Teaspoonfuls or 1 Dessertspoonful
ʒiv) Four Drachms or) ℥ss (Half a fluid ounce (	4 Teaspoonfuls or 1 Tablespoonful
℥i One fluid ounce ...	2 Tablespoonfuls
Oi One pint (℥xx) ...	1 Pint

Popular measures are very inaccurate, and if the dose of medicine is not marked on the bottle it should be measured in a medicine glass. Drops vary according to the thickness of the fluid. A teaspoon often contains ninety minims instead of sixty, and a tablespoon three-quarters of a fluid ounce instead of a half. A sherry wine-glass holds about two fluid ounces : a teacup, four to six : a breakfast cup, six to eight : and a tumbler, ten, or half-a-pint.

COMPONENTS OF COMMON FOODS.

100 Parts of each.	Water, &c.	Muscle making.	Heat & produci
Apples	84·0	5·0	
Barley	14·0	15·0	6
Beans	14·8	24·0	5
Beef	50·0	15·0	3
Buckwheat	11·2	8·6	7
Butter	—	—	
Cabbage	90·0	4·0	
Carrots	91·8	0·6	
Cauliflower	89·0	6·4	
Cheese	10·0	65·0	1
Chicken	46·0	18·0	3
Clam	85·0	12·0	
Codfish	79·0	14.0	lit
Corn	14·0	12·0	7
Cucumbers	97·0	1·5	
Eels	76·0	17·0	
Eggs, white of	53·0	17·0	no
Eggs, yoke of	69·0	5·0	2
Fat	—	—	
Flounder	78·0	15·0	lit
Haddock	80·0	13·0	lit
Halibut	74·0	18·0	lit
Herring	75·0	18·0	lit
Lamb	50·5	11·0	3
Lobster	79·0	14·0	lit
Milk, Cow's	86·0	5·0	
Mutton	44·0	12·5	4
Oats	13·6	17·0	6
Oysters	87.0	10·0	lit
Parsnips	90·0	2·0	
Peas	14·0	23·4	6
Pork	38·5	10·0	5
Potatoes	75·2	1·4	2
Potatoes, sweet	68·5	1·5	2
Rice	13·5	6·5	7
Rye	13·0	13·8	7
Salmon	72·0	20·0	lit
Starch	—	—	a
Sugar	—	—	a
Trout	75·0	17·0	lit
Turbot	79·0	14·0	lit
Turnips	94·4	1·1	
Veal	68·5	10·1	1
Wheat	14·0	14·6	6
Whiting	78·0	15·0	lit

TIME REQUIRED FOR DIGESTION.

From Dr. Beaumont's tables, it appears that the following articles were converted into chyle—that is, digested—in the times indicated.

	H.	M.
Rice, boiled soft	1	0
Apples, ripe	1	30
Sago, boiled	1	45
Bread, stale	2	0
Milk, boiled	2	0
Cabbage	2	0
Baked Custard	2	45
Parsnips, boiled	2	30
Potatoes, roasted	2	30
Potatoes, boiled	3	30
Turnips, boiled	3	30
Carrots, boiled	3	15
Butter and Cheese	3	30
Venison	1	35
Oysters, raw	2	3
Oysters, stewed	3	30
Eggs, raw	2	3
Eggs, soft boiled	3	0
Eggs, hard boiled	3	30
Beef, roast or boiled	3	0
Beef, salted	5	30
Mutton, roast or boiled	3	0
Pork, boiled	3	30
Pork, salt and boiled	5	30
Pork, roast	5	30
Veal, roasted	5	30
Turkey and Goose	2	30
Domestic Fowls	4	0
Wild Fowls	4	30

DIETETIC DONT'S.

1. Don't allow a baby to suck a "comforter," "dummy teat."

2. Don't permit the baby to suck at any en feeding bottle.

3. Don't employ a long tube feeding bottle.

4. Don't give the baby the feeding bottle or br directly he cries—first be certain that the cry is really of hunger.

5. Don't give a baby food "between meals"; every endeavour to induce regular habits in feeding.

6. Don't allow a baby to feed rapidly or gree —train the infant to swallow slowly.

7. Don't give a baby who has not cut some t any kind of starchy food, such as would thicken w milk or water. No such substances as cornflour, arr root, sago, biscuits or bread should be given.

8. Don't give a baby skimmed milk, or milk tha not perfectly fresh.

9. Don't feed a young infant exclusively for length of time upon any diet from which fresh raw is excluded.

10. Don't give the baby fever powders or sleep draughts, save under medical advice.

11. Don't allow a baby to have fragments of prepared for adults.

12. Don't permit a baby to have tea, coffee, beer any kind of stimulating liquor.

13.—Don't give a young baby fruits of any —although the *juice* of ripe fruits may be given in sm quantities.

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Advantages

OF THE

Mellin's Feeding Bottle

1.—When in use the Food is kept in conta with the teat, without an air space, until th bottle is emptied; and the swallowing of air by th child is thus obviated.

2.—Mellin's Feeding Bottle, being egg-shape is easy to cleanse.

3.—Mellin's Feeding Bottle is graduated to sho both tablespoonfuls and the **quantity of mixe food required by children at different ages** and thus it facilitates artificial feeding.

4.—The teat is non-collapsible, and offers th same resistance in the mouth to the pressure of th child as the human nipple, and consequently it guard against what is so frequently a source of trouble viz., the collapsed teat.

5.—The valve for the admission of air is con structed so as to preclude the possibility of leakage at the same time admitting air only so gradually a to satisfy the suction-power of the weakest child.